UNIVERSITY OF CAPE COAST

EFFECTS OF EUROPEAN UNION'S ENVIRONMENTAL POLICY STRINGENCY ON GHANA'S EXPORTS: DOES THE QUALITY OF INSTITUTION MATTER?

OBED KISSI ADONTENG

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BY

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Thesis submitted to the Department of Economic Studies of the School of Economics, College of Humanities and Legal Studies, University of Cape Coast, in partial fulfillment of the requirements for the award of a Master of Philosophy degree in Economics.

MAY 2023

DECLARATION

Candidate's Declaration

I hereby declare that this thesis is the result of my original work and that no part of it has been presented for another degree in this university or elsewhere.

Signature…… Date……

Candidate's Name: Obed Kissi Adonteng

Supervisors' Declaration

We hereby declare that the preparation and presentation of this thesis were supervised following the guidance on supervision of thesis laid down by the University of Cape Coast.

Signature…… Date……

Principal Supervisor's Name: Camara K. Obeng (PhD)

Signature…… Date……

Co-Supervisor's Name: Mark Armah (PhD)

ABSTRACT

The study sought to examine the effects of the European Union's environmental policy stringency on Ghana's exports. In addition, the study also sought to examine how Ghana's institutions affect the adoption of the European Union's environmental policy stringency in her exports. The study employed the Stochastic Frontier Gravity Model on exports to 17 European Union member countries from Ghana using data from 1990 to 2019. The study revealed that the European Union's environmental policy stringency negatively affects Ghana's exports. Like the European Union's environmental policy stringency, institutional quality was also found to negatively affect Ghana's export. In addition, the study found that Ghana's institutions perform poorly in helping with the policy compliance. As such, the study therefore recommends that the Ghanaian Government initiate a discussion on the harmonization of standards with the European Union in a mutually beneficial arrangement to primarily lessen disparities in standards. The study also recommends that, strengthening institutions (like the Environmental Protection Agency, Ports and Harbors Authority, Ghana Standards Authority, Customs services etc.) in charge of regulating exports would help minimize the pollution haven effect.

KEYWORDS

Environmental policy Stringency

European Union

Institutional Quality

Porter Hypothesis

Pollution Haven Hypothesis

Export

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DEDICATION

To my mother, Dolphina Larweh and Grandmother, Elizabeth Adonteng Kissi

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LIST OF ABBREVIATIONS

ACP	African Caribbean and Pacific group of states
EEC	European Economic Community
EPA	Economic Partnership Agreement
EPS	Environmental Policy Stringency
EU	European Union
GATT	General Agreement on Tariffs and Trade
GDP	Gross Domestic Product
IMF	International Monetary Fund
OECD	Organisation of Economic Cooperation and Development
SFA	Stochastic Frontier Approach
SFGM	Stochastic Frontier Gravity Model
SITC	Standard International Trade Classification
WTO	World Trade Organization

CHAPTER ONE

INTRODUCTION

Globalization has created a compression of distance and time, which has resulted in a rapid expansion of international and worldwide economic growth. This has been made possible through decreasing communication costs, improved media tools (such as the World Wide Web), increased access to a wider range of transportation options thanks to technological advancements, and other forces of globalization that have made distance less of a barrier than it once was. According to the literature, this increase in transportation options at a lower cost is crucial for facilitating international trade and boosting economic activity (Anderson & van Wincoop, 2004; Berthelon & Freund, 2008; Baier, Kerr & Yotov, 2018).

The astronomical increase in global trade has also coincided with a sharp increase in global environmental deterioration, as seen by rising air and marine pollution, desertification and deforestation, biodiversity loss, and climate change (Falkner & Jaspers, 2016). This development has triggered a debate over whether or not international trade is the cause of environmental degradation. Huang and Labys (2002) assert that globalization has resulted in serious environmental deterioration as a result of trade and regional economic expansion. Also, Multinational corporations have wreaked havoc on the global environment by relocating operations to nations with lax or non-existent environmental rules (Bordoff ,2017).

The argument against the proposition that trade leads to the deterioration of the environment postulates that trade barriers can be created using environmental

controls on products or their disposal to achieve the needed environmental goals (Runge,1990; Panayotou, 2000; Esty, & Ivanova, 2004) in spite of the concerns that under the name of environmental protection, trade flows will be restricted.

Background of the study

It is commonly established that freer trade generates economic benefits, particularly through specialization based on comparative advantages (Krueger 1980, Grossman & Krueger,1991; Pugel, 2007; WTO, 2013; World Bank, 2012). There are also other benefits to freer trade, such as having a broader market to pay large sunk expenditures or having a larger variety of variants of the same commodity available to customers (Casacuberta, Fachola, & Gandelman, 2004; Kien & Heo, 2009; Albulescu, Boatca-Barabas, & Diaconescu, 2021).

Theoretically, free trade is seen to have contradictory effects on the environment; it can increase environmental pollution or promote reduction in environmental pollution. First, through a scale effect, trade leads to an expansion in the size of the economy, tends to generate pollution, and could cause environmental quality to deteriorate through pollution-intensive activities (Kunce, 2000; Dean,2002; and Frankel & Rose,2005).

Second, through the technique effect, trade can contribute to environmental cleansing by tightening pollution policies in reaction to the greater income that trade encourages, which spurs pollution-reducing innovation and investment (Liddle, 2001). The environmental Kuznets curve establishes that at the initial stages of economic activity, pollution increases but as incomes increase further, pollution decreases. Stated more formally, this means that the income elasticity of demand for environmental resources varies with the level of income. If the

expansion of freer trade is successful in achieving the desired results, the demand for goods and services related to subsistence will fall as incomes grow. Because it is within their means, citizens will typically seek high environmental amenities, more efficient disposal of waste, and demand stricter environmental standards. This will spur pollution reduction investment and innovation (Kellenberg, 2008; Iwata, et al (2010), and Leitão, A. (2010).

Third, a composition effect also exists, in which pollution from the manufacturing of pollution-intensive goods decreases in one country while increasing in another via the trade of that good. The pollution haven hypothesis, which contends that lax environmental regulations would turn into a source of comparative advantage and hence promote changes in trade patterns, may be primarily responsible for the emergence of the composition effect. The pollution haven hypothesis expects freer trade to lead to more rapid growth of pollution-intensive industries in developing countries as developed countries enforce stricter environmental regulations (Levinson & Taylor, 2008; Cherniwchan, et al, 2017; Sadik-Zada & Ferrari, 2020).

In reality, there is likely some truth in all three arguments. The total effect of international trade on the environment is possibly a change or an increase in the level of pollution, rising incomes, and increasing demand for environmental quality. Generally, total degradation and pollution will be a function of increasing economic activity and the technique used in production. For instance, it is known that increased liberal trade could intensify the overexploitation of natural resources and cause habitat degradation if not properly regulated (Muradian & Martinez-

Alier,2000: Lenzen, et al, 2012). The solution to managing this tradeoff effect is to establish rules controlling resource use in the interest of long-term sustainability. Such rules would presumably benefit everyone by preventing overexploitation of the resource and/or its destruction (Acheson, 2006).

But if institutions are ineffective or weak, there is no guarantee that such rules will bring favorable results. Muradian and Martinez-Alier (2001), Alam (2007), and Albulescu, et al. (2021) find evidence of this effect. Poor countries with weak institutions become the real losers by bearing the environmental load of affluent consumption. Even if trade is not the primary driver of environmental degradation, trade in countries with poor institutions worsens biodiversity destruction (Alam, 2007; Albulescu, et al, 2021).

According to Sadik-Zada and Ferrari (2020), 91 percent of Europeans perceive climate change to be an existential threat, per a study conducted by the European Investment Bank (EIB). To combat environmental damage, 72 percent of Europeans support the introduction of a carbon tax on consumption. While44% are in favor of tighter pollution regulations in business, particularly in the energy sector. As a result, there is considerable consensus that environmental measures contribute to well-being and long-term growth sustainability. They work to attain environmental goals that markets are unable to meet. To influence both producer and consumer behavior, such policies tend to make pollution and, more broadly, environmental services more burdensome.

The European Union's (EU) environmental policy has been widely considered a "success story" since the enactment of the first piece of EU

environmental legislation (Lenschow & Sprungk, 2010). It has some of the world's highest environmental standards, developed over the decades. The policies seek to protect the marine, coastal environment and other water resources, control noise pollution, help cities and towns manage their areas of sustainability, safeguard the health and wellbeing of labour, ensure clean air, and protect other natural resources. Averagely, the EU's environmental policies have become more restrictive over time, as measured by the Environmental Policy Stringency (EPS) indicator in Figure 1 below.

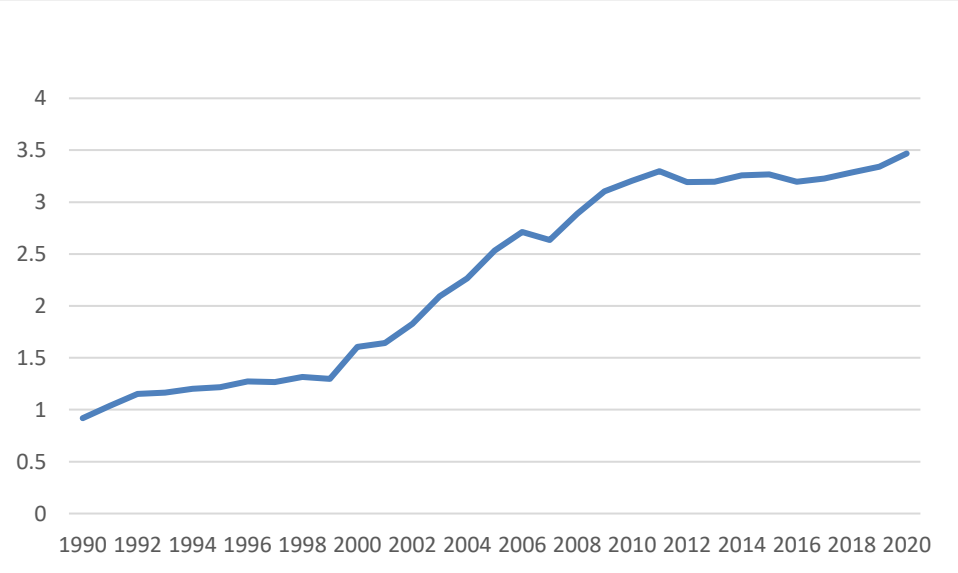

Figure 1: Average EPS indicator scores for EU countries for the period 1990-2019.

Source: Author's Computation using data from OECD. Stat, 2022.

Hence, it's not surprising that the European Union (EU) recorded an emission reduction of 24% between 1990 and 2019 (Albulescu, et al, 2021). However, with this increasing trend of environmental policies in Europe some fear that under the name of environmental protection, de facto trade restrictions may be established.

Europe has long held a significant position as a vital destination for Ghana's exports, owing to its expansive domestic market and the enduring legacy of their extensive political and commercial ties. Ghana's ability to engage in trade with the European Union (EU) is facilitated by its membership in the African, Caribbean, and Pacific group of countries (ACP). Ghana is among the 79 nations that have signed the Cotonou Agreement, which represents an extensive partnership between the EU and developing countries within the African, Caribbean, and Pacific Group of States. This agreement aims to strengthen development, political, and economic collaboration between the parties involved. The EU's 27 member states collectively are currently Ghana's second-largest export market after China and its second-largest source of imports (European Union, 2020; Eurostat, 2021). From 1990 to 2021 the European Union has accounted for about 26 percent of overall Ghanaian exports destination as a bloc , followed by China, India, and the United States accordingly as shown in Figure 2.

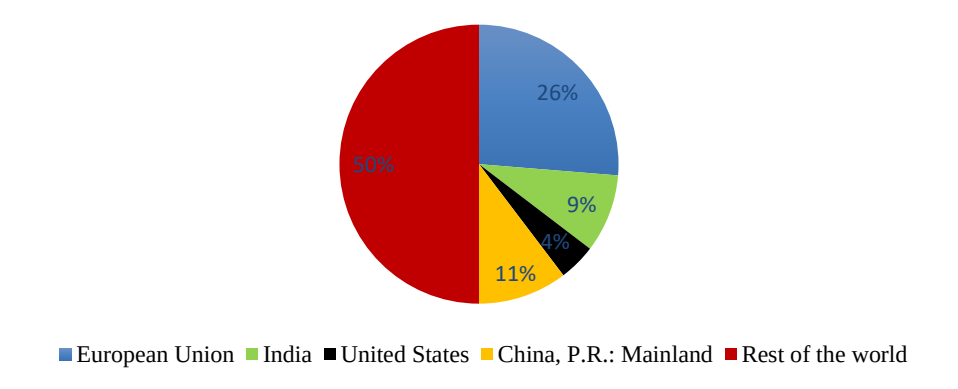

Figure 2: Share of Ghana's export by countries and Regions from 1990 – 2021.

Source: Author's Computation using data from IMF DOTS, 2022.

Raw materials make up the majority of exports. The main EU markets include the Netherlands, France Italy, and Germany. In 2019, Ghana's top export products to the European union included petroleum oils, cocoa products, vegetable fats and oils, fruits, and raw aluminum.

Data from IMF's Direction of Trade statistics show that between 1990 and 2021, the European Union remained Ghana's top export destination with the value of Ghana's exports to the EU more than doubling as shown in figure 3. The period of 2011 saw the gradual rise of other emerging markets such as China having an increasing share of Ghana's export, with China finally being the leading export destination in 2019. Nevertheless, the proportion of Ghana's exports to the EU remains disproportionately large compared to the USA and emerging markets like India. Over the last 15 years, Ghana's export to the European Union has increased by over 100 percent amounting to over 2 billion in 2021.

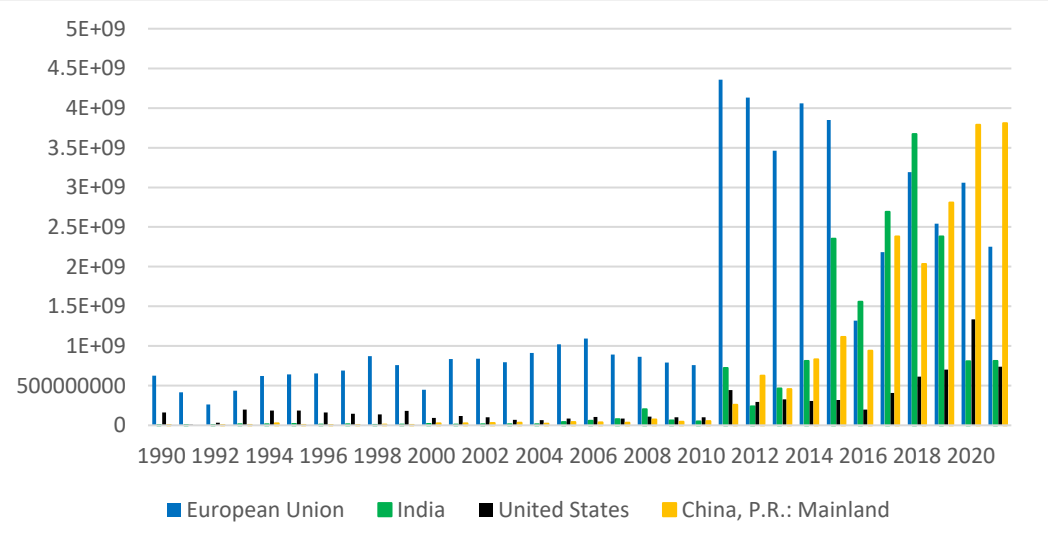

Figure 3: Trend of Ghana's export to the EU and other countries for the period 1990-2021

Source: Author's construct using data from IMF's DOTS, 2022

Exports from Ghana to the European Union followed an upward trend until 2011 when a decreasing trend became quite obvious. However, as can be seen in Figure 1, environmental policies in Europe have become more stringent over time. Ghana with its lax environmental standards has attracted multinational corporations and is likely to export large amounts of pollution-intensive goods. This means that these firms would have to incur additional costs in order to satisfy these strict environmental regulations. Thus, producers and firms would be compelled to devote some resources to pollution reduction, which comes at an additional cost, and will erode their global competitiveness and hence reduce exports. This position or view is referred to as the pollution haven hypothesis. Contrary to this view, the porter hypothesis suggests this strict foreign environmental regulation will encourage innovations that will induce efficiency and lead to export competitiveness. Which of these two opposing hypotheses applies to Ghana?

It is also important to point out the growing concerns about the role of institutions in protecting the environment and driving economic activity in developing countries. This includes various unethical behaviors such as misappropriation of funds during the execution of environmental initiatives, significant corruption in granting permits and licenses for exploiting natural resources, and petty bribery of law enforcement personnel. Another piece of evidence from Ganda (2020) of corruption is the minimization of stringent strategies and policies and the theft of natural resources. The OCED (1997) argues that corruption has demonstrated high impacts in less industrialized countries than high industrialized nations even though it is a common issue in both economies.

It is commonly acknowledged that enhanced institutional quality and an improved governance environment have the potential to lower business costs and foster a more effective business climate. This, in turn, can positively impact bilateral trade (Anderson & Marcouiller, 2002; Wu, Li, & Samsell, 2012; Bilgin, Gozgor, & Demir,2017). This hypothesis is strongly supported by Álvareza, et al. (2018) who argue that bilateral trade is positively affected by the quality of the institutions involved. This means that the quality of institutions in Ghana has a role to play when it comes to environmental policy compliance and trade efficiency.

Contrary to the reality prevailing in Ghana, the average quality of institutions indicator over the years has been generally poor as can be seen from the graph below (Figure 4). The quality of institutions as measured by the average of the six World Governance Indicators in Ghana has barely improved or has even been worse over the years as shown in Figure 4. The indicator is graded on a scale of -2.5 to 2.5, with 2.5 denoting strong institution.

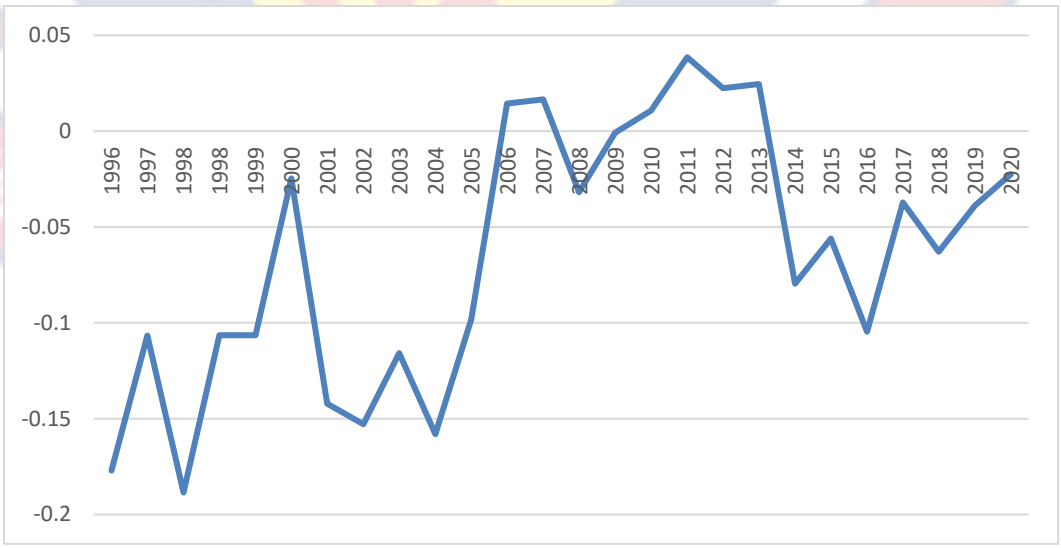

Figure 4: Trend of Ghana's Institutional Quality for the period 1996 – 2020.
Source: Author's Construct using data from World Governance Indicators,2022.

The United Nations (2020) also re-echo's the point that strong institution is needed for effective environmental action policy compliance and facilitation of economic activity. Concerningly, Ghana's trade is anticipated to see growing issues as a result of poor institutions at a time when the globe, and the European Union, in particular, are becoming more conscious of environmental practices. Thus, when weak institutions become rampant, economic activities predispose the environment to continues damage owing to weak legislation which in turn comes back to affect economic activity. This would decrease the flow of economic goods into places with high environmental standards. The work lies on institutions to make things right; force manufacturers and all economic agents in the production chain to do the right thing by adhering to or considering global environmental standards during production and this would mean that foreign environmental stringent policies won't be a problem for exporting countries.

With this background, Ghana's export performance will be assessed in the context of the increasing trend of the European Union's environmental policy stringency, to ascertain whether the European union's environmental policy stringency improves the country's export performance or hinders its growth.

Statement of the Problem

The rising environmental disasters and mounting scientific evidence that the world is approaching an environmental tipping point have compelled a growing number of nations to enact stringent environmental regulations to minimize local and global environmental repercussions (OECD, 2012). The European Union (EU) and its member states have leveraged the EU market's attractiveness to persuade

trade partners in developing countries to adopt more socially and environmentally sustainable practices (Woolfrey & Karkare, 2021). Such a strategy is dependent on, for example, the Ghanaian market's (a major trading partner of the EU) capacity to incorporate the EU's more rigorous environmental policies into production and export.

Recent developments and trends both in the EU and globally bring this into question. All EU nations' environmental rules are getting increasingly stringent over time, and since the European Union has been known to be the home of the majority of Ghana's exports, it raises concerns about the impact of this increasingly stringent environmental policy on the country's export competitiveness in Europe. Per the pollution Haven hypothesis, this could reduce the competitiveness of Ghana's export through increasing the cost involved in producing and exporting. However, the porter hypothesis asserts that it would improve export competitiveness by driving pollution related innovation.

Even though the majority of the available literature found considerable new and convincing evidence linking tighter environmental regulations to lower net exports (or higher net imports) thus supporting the pollution haven hypothesis (Muradian & Martinez-Alier, 2000; Frankel & Rose, 2005; Levinson & Taylor, 2008; Cherniwchan, Copeland, & Taylor, 2017; Sadik-Zada & Ferrari, 2020;), studies like Ederington, Levinson, and Minier (2005), Levinson and Taylor (2006), have also found evidence supporting the Porter hypothesis.

The role of institutions in protecting the environment has been highlighted in the literature (Andersson, 1991; Dechezleprêtre & Glachant,2013; Rubashkina,

Galeotti, and Verdolini, 2014; Mansbridge, 2014; Kulin & Sevä, 2019). Institutions ensure compliance with environmental regulations during international trade and other economic activities. However, aside from the fact that all the studies cited were carried out in developed and industrialized nations, none of them examined the effectiveness of institutions in enforcing these environmental laws.

In developing and underdeveloped countries institutions have been found to be ineffective and corrupt. Corrupt and inefficient institutions generally respond to political pressure rather than maximize social welfare and these acts have the ability to hurt actual export potentials since they do not ensure export firms produce and export environmentally sustainable products. It is for this reason that the study seeks to explore the effect of the European Union's Environmental policy stringency on the performance of Ghana's export taking into consideration the ability of institutions in enforcing environmental policies.

Purpose of the Study

The study sought to investigate the effects of the European Union's (EU's) Environmental Policy Stringency on Ghana's bilateral exports to the EU considering the quality of Ghana's institutions.

Research Objectives

The specific objectives of the study were to:

1. estimate the effect of the EU's environmental policy stringency on Ghana's bilateral exports to the EU.
2. examine the effect of Ghana's institutional quality on its export to the EU.
3. explore the joint effect of the EU's environmental policy stringency and Ghana's institutional quality on Ghana's bilateral exports to the EU.

4.

Research Hypotheses

1. H_0: The EU's environmental policy stringency has no significant effect on Ghana's bilateral export

H_1: The EU's environmental policy stringency has a significant effect on Ghana's bilateral export.

2. H_0: Ghana's institutional quality has no significant effect on its exports to the EU.

H_1: Ghana's institutional quality has a significant effect on its exports to the EU.

3. H_0: The EU's environmental policy stringency and Ghana's institutional quality have significant no joint effect on Ghana's bilateral exports.

H_1: The EU's environmental policy stringency and Ghana's institutional quality have a significant joint effect on Ghana's bilateral exports.

Significance of the study

Environmentally friendly practices are necessary for the survival of the Ghana's export competitiveness, especially in this period of rising environmental awareness. Although some studies have been undertaken, the impact of foreign environmental policy stringency on a country's export has received little attention in the literature, particularly in Ghana. As a result, this research is regarded significant. The study's goal is to raise awareness in Ghana on the importance of taking the environmental policies of major trade partners into consideration during the production and export process.

The 2030 agenda for Sustainable Development and the Sustainable Development Goals (SDGs) propose that nations strive for sustainable development across three key dimensions: economic, social, and environmental. In this regard, international trade is anticipated to contribute significantly towards the realization and attainment of these SDGs. The study will help in this direction as well by bridging the academic gap in the literature which ideally is supposed to be a reference point for policy makers in Ghana. The findings of this study will help authorities in various public and private institutions in charge of production and making trade policies to make strategic decisions that will improve trade performance.

The study's recommendations would include suggestions for exporters to help them meet the environmental criteria of their European trading partners. In addition to strengthening the information on export performance in connection to the environmental regulations of trade partners, this research would also serve as a foundation for future studies and provide secondary motivation and success data for researchers and academics.

Delimitations

The study focused on Ghana's export to the European Union only. Reference to other nations was only either to buttress a fact or make a comparison. The EU was made up of 28 member countries but the United Kingdom officially exited the Union in January 2020 making the current membership 27. The study covered bilateral export to 17 European Union member countries. The study specifically focuses on examining the effect of the European Union's

Environmental Policies on Ghana's export. The study also considered the quality of institutions in Ghana.

Limitations of the Study

A major problem this study encountered was data availability. This limited the study's time frame to 1990 up to 2019. Also, the limited availability of data on bilateral export flows and other variables imposed a constraint on the number of trading partners selected for the study. In that regard, the number of European union member countries selected was limited to 17 countries. However, these data limitations do not reduce the precision, quality and findings of the estimated results.

Organisation of the Study

The study was made up of six chapters. Chapter one looked at the background of the study, statement of the problem, research objectives and significance of the study, limitations, and organization of the study. Chapter two discussed the overview of Ghana's trade with the European Union. Chapter three reviewed the literature available on environmental policies, institutional quality, and their relationship with exports. Chapter four described the research methods that were used in the study: this included the population size, sample size, and sampling techniques as well as methods of data collection and data analysis. Chapter five also presented the results and discussion based on research questions. Chapter six provided a summary, conclusions, and recommendations, and provides direction for further studies to be conducted.

CHAPTER TWO
OVERVIEW OF GHANA'S TRADE WITH THE EUROPEAN UNION

Introduction

This Chapter presents an overview of Ghana's trade with the European Union. It brings to light the history of Ghana's trade relations with the European Union as well as the components and pattern of trade.

History of Ghana- EU Trade Relations

The establishment of the formal relationship between the European Union (EU) and Ghana can be traced back to the inception of the European Economic Community (EEC) through the Treaty of Rome in 1957. During the period of accelerated decolonization in Africa, starting from 1960, European nations aimed to maintain their economic relationships with the majority of associated states. In 1975, the trade relations between Ghana and the EU commenced officially with the signing of the Lomé Convention (Gbedoah, 2018). Prior to this agreement, the Francophone African nations formed trade collaborations with Europe through the Yaoundé Convention (1963), laying the foundation for their economic cooperation. Before this agreement, the Yaoundé Convention (1963) created trade cooperation between the Francophone African nations and Europe.

The Lomé Convention was created as a result of the expiration of this agreement, other developments including the United Kingdom joining the European Community (and the requirement to include her former colonies in the economic relations), and the African Caribbean and Pacific countries'(ACP) determination to negotiate as a bloc. This agreement that formally started Ghana-EU trade witnessed a revision to Lomé Convention II in 1979 where development

assistance was added to cushion ACP countries from the effect of price fluctuations and other effects of negative trade. Further revision of the agreement (Lomé Convention III) in 1984 introduced a focus on promoting food security and self-security amongst ACP states.

The inclusion of democratic principles, human rights, and the rule of law in EU trade with ACP countries, including Ghana, was introduced during the final Lomé Convention IV in 1989. However, it is worth noting that Ghana-EU trade under Lomé IV, starting from 1995, was carried out under a waiver obtained by the EU from the WTO. This waiver was necessary because the preferential arrangement of Lomé IV was found to be in violation of GATT/WTO principles, particularly in relation to the absence of similar privileges for non-ACP developing countries and LDCs, as pointed out by Patel (2007). Patel (2007) highlights that this inherent inconsistency, combined with the EU's aim to align trading relations with WTO rules, led to a shift towards the Economic Partnership Agreement (EPA).

Ghana-EU negotiations on the EPA started in September 2002 (Acheampong, et al, 2014). The negotiation process for the EPA initially involved regional groupings, but due to disagreements over market access, development status, and other regional disparities, progress was hindered. As a result, Ghana opted to sign an individual agreement in December 2007, while some regional groups, including CARIFORUM, managed to negotiate as a collective (Gbedoah, 2018). In December 2016, Ghana's interim Economic Partnership Agreement (EPA) with the EU came into effect. Among the West African countries, only Cote d'Ivoire and Ghana signed an interim EPA, as other regional nations were not ready

to commit to the agreement. Once the regional EU-West Africa EPA becomes effective, this agreement will be replaced (European Union, 2022).

The EPA is an agreement focused on promoting development and facilitating free trade. It ensures that Ghana's exports receive unrestricted access to the European Union (EU) without any duties or quotas, starting from the moment the agreement comes into effect. In return Ghana is undergoing a gradual liberalization of approximately 80 percent of its imports from the EU. According to Otchere (2018), the advantages derived from trade, economic collaboration, and the development of agreements by both nations are focused on creating favorable conditions for the private sector. The EU continues to be one of Ghana's key trading partners and a top destination for goods exported from Ghana.

Ghana's Trade with the European Union

The Interim EPA between Ghana and the EU incorporated certain provisions that exempted a total of 1,038 items from the scope of liberalization. Among these exclusions, approximately 32.5% pertain to agricultural products, which are already subject to regulations established by the WTO. Notably, around 85% of the items excluded fall under the highest tariff band of 20%, while 10% are categorized under the lowest tariff band of 10. Noteworthy trade activities between Ghana and the EU consist of imports primarily composed of chemicals, industrial goods, vehicles, and machinery sourced from the EU. On the other hand, exports from Ghana to the EU are predominantly comprised of primary products, particularly food and live animals, mineral fuels, crude materials, lubricants, and related materials (European Commission Directorate-General for Trade, 2021).

Based on the SITC section, Figure 5 and 6 below shows the top products which have dominated trade flows between Ghana and the European Union from 1999 to 2021.

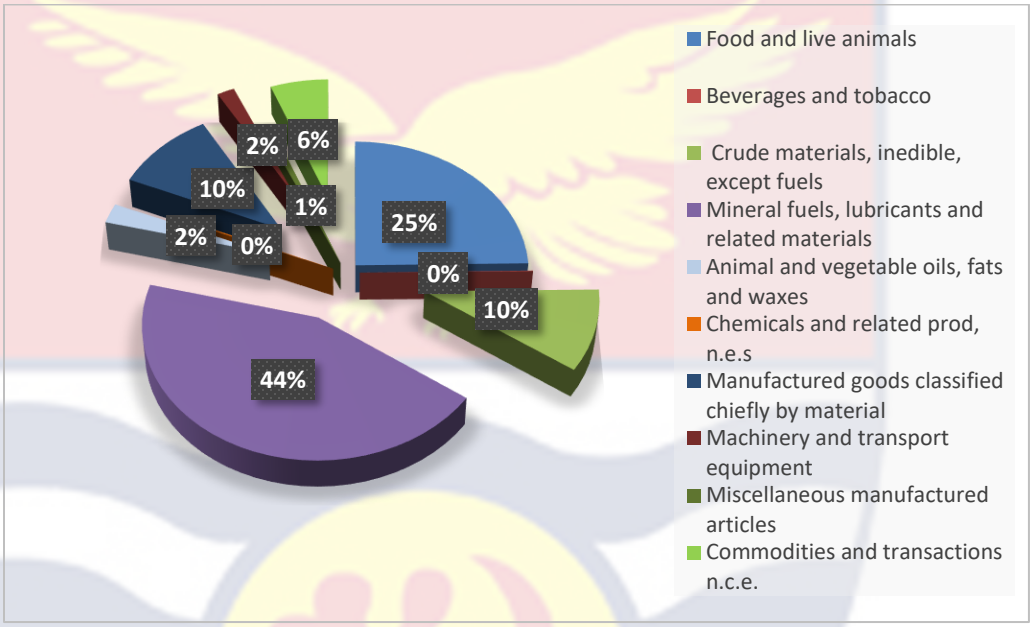

Figure 5: Share of specific Ghanaian export products to the European Union From 1999 - 2021

Source: Author's construct using data from Eurostat,2022.

For the last 21 years, the export of mineral fuels, lubricants, and related materials have dominated Ghana's export to the European Union. The export makes up about 44 percent of Ghana's total exports to the European Union. This is followed by food and live animals with a value of 25 percent of the total export to the European Union. Manufactured goods classified chiefly by materials, and crude materials, inedible, except fuels have a share of 10 percent each of the share of total exports. Commodities and transactions not classified elsewhere in the SITC also make up 6 percent of total exports to the EU. This is followed by animal and

vegetable oils, fats, and waxes make up 2 percent of exports. Similarly, Machinery and transport equipment also make up 2 percent of total export to the EU. Chemicals and other related products make up 1 percent of the total products. Miscellaneous manufactured articles make up 1 percent of the total exports . Figure 6 below also shows Ghana's imports from the European union for the same period (1999-2021).

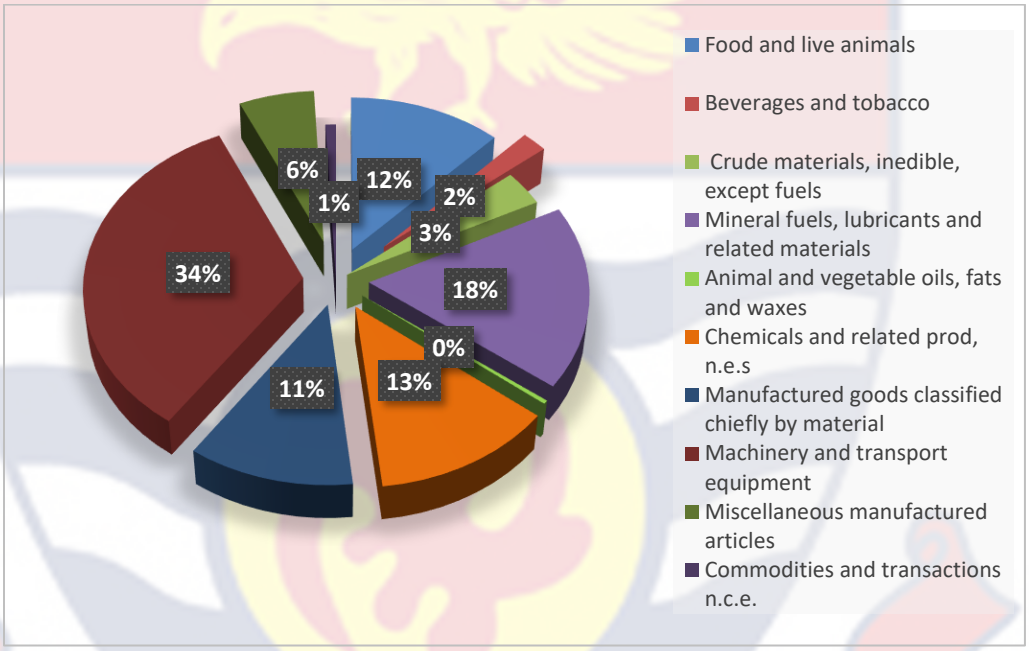

Figure 6: Share of specific Ghanaian imported products from the European Union From 1999 - 2021

Source: Author's Construct using data from Eurostat, 2022.

This period of trade has seen Machinery and transport equipment as the highest imported products from the European Union. This makes up of 34 percent of the overall exports during the period. This is followed by the import of Mineral fuels and related materials as the next imported products. It makes up 18 percent of the overall total exports throughout the period. Chemicals and related products are

next with 13 percent of the total imports from the European union. Food and beverages, and Manufactured goods classified chiefly by material have a share of 12 percent and 11 percent respectively of the total imports from the European union. The next most imported commodities after these are Miscellaneous manufactured articles. This makes up 6 percent of the total imports from the European Union. Crude materials, inedible except fuels also make up 3 percent of the import from the EU. This is followed closely by the import of beverages and tobacco. This makes up 2 percent of the overall imports from the EU. Over the years Ghana's trade with the EU has increased on average until recently.

With data from IMF's Direction of Trade Statistics database, the graph below shows the trend of Ghana's trade with the European Union in millions of US dollars.

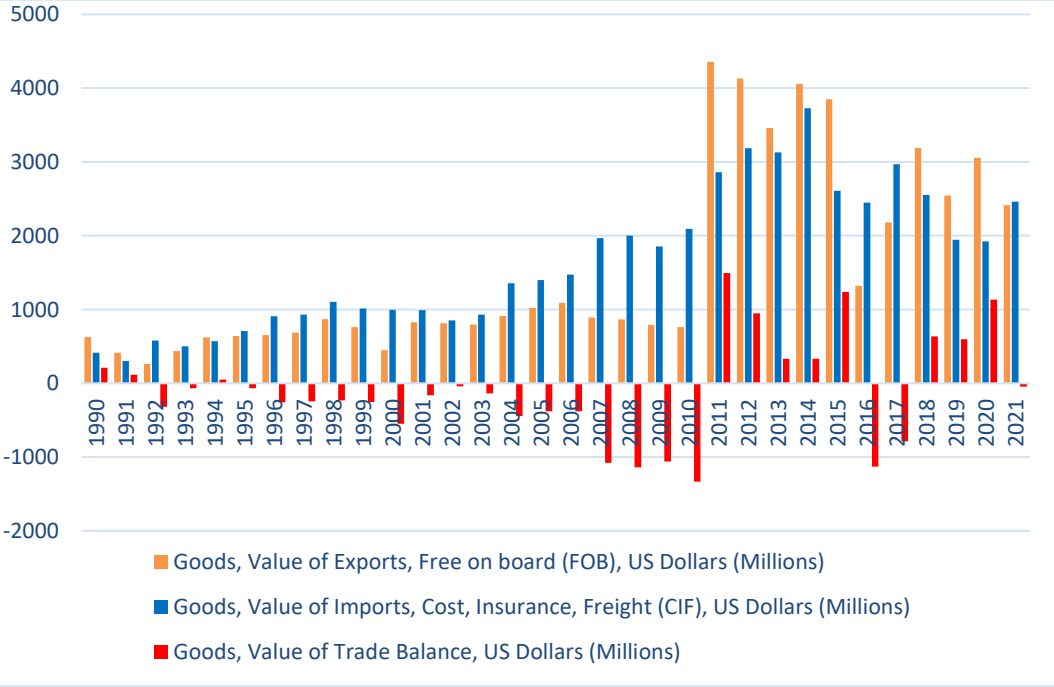

Figure 7; Trend of Ghana's Trade with the European Union from 1990-2021

Source; Author's Computation, 2022 using data from IMF's DOTS, 2022

Exports have averagely increased over time until 2015 when they began seeing a decline. Since 1990, imports have followed a similar path until 2015, when they started to decline. Trade peaked between Ghana and the EU peaked in 2014 when the combined value of imports and exports summed up to about 7789.17 million US dollars. The balance of payments (difference between exports and imports) has varied from year to year across the period, displaying an irregular pattern. However, one certain thing as can be shown in figure 7 is that the period between 1990 and 2021 has seen more years of negative balance of payments than positive balance of payments.

The share of Ghana's trade with the European Union on the other hand has followed quite a different story. Figure 8 below shows the share of Ghana's trade with the EU.

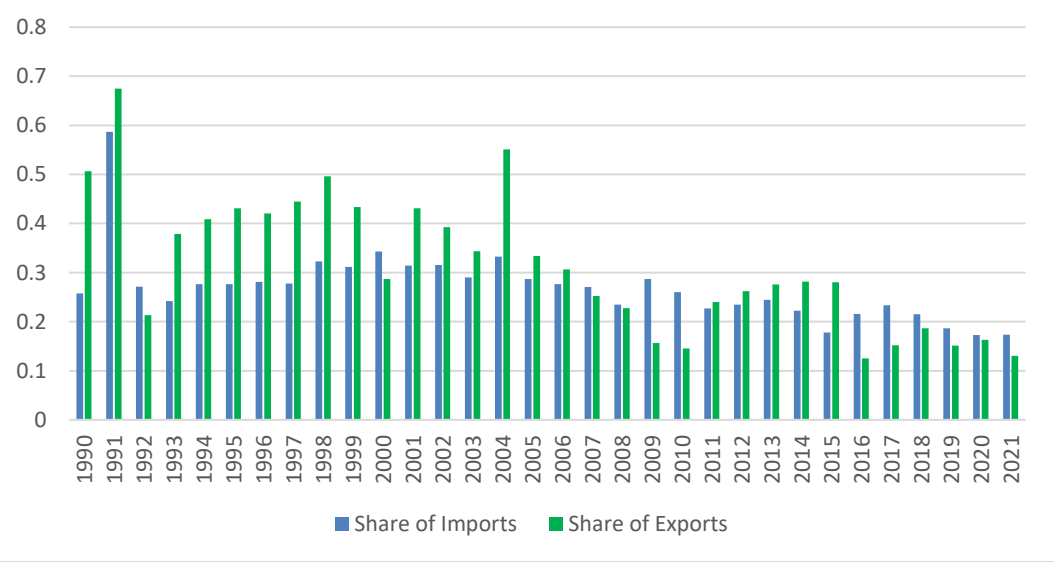

Figure 8; Share of Ghana's Trade with the European Union from 1990-2021

Source; Author's Computation, 2022 using data from IMF's DOTS, 2022

Despite the average rise in trade between Ghana and the EU, Ghana's trade share to the EU has generally dropped over time. While about 67.5 percent of the total exports found its way to EU market in 1991, by 2010 the export share to EU had declined to about 14.5%. In between this long period, Ghana's export share to the EU fell sharply from around 67.5 percent to 21.3 percent in 1992.The period from 1993 saw a gentle and gradual rise of the share Ghana's of Ghana's export to 49.5 in 1998, after which the share of the country's export went on a free fall with an outlier in 2004.

By the end of 2010 Ghana's export share to the EU had declined to about 14 percent. After 2010, a similar pattern also emerged, with the share of exports to the EU rising from 24 percent in 2011 to 28.1 percent in 2014 and then declining to an estimated value of 13 percent in 2021. Just like exports, the share imports of imports have been a fall since 1991 even though there are noticeable periods of rise within the period of 1991 to 2021. From 27.1 percent in 1991 to 34.3 percent in 2000, Ghana's import share increased throughout this time period, but it has since been declining, reaching a figure of 17.3 percent in 2021.

Challenges faced in Trade between Ghana and the EU

Even while trade with the European Union and global commerce, in general, has produced enormous benefits, there have been and continue to be some constraints in the process. These constraints will be looked at in two dimensions, internal and external constraints. Internal constraints are challenges faced by Ghana as a result of the inability of internal structures to facilitate and meet certain economic standards to help improve her trade market. Some of the internal related problems include a lack of capacities and the trade-related infrastructure for

integration into the world trade system despite increased access to the EU market. This makes Ghana ineffective to perform in the world market, though there are opportunities for them to improve (Yennu, 2018)

Land acquisition is a major constraint most investors face. Challenges such as difficulty in the acquisition of land, weak regulatory procedures, delays in regularizing land-related issues, costly transportation systems, and inadequate feeder roads. Because a sizable amount of our exports to the EU are predominantly agricultural products, this issue poses a hurdle to the expansion of the country's exports to the EU. Agricultural products exported to the Eu are submitted to EU requirements because of the environmental provisions in the EPA. To protect consumers' health and the environment, the EPA has sanitary, phytosanitary and other environmental standards that Ghana have to comply with before consignments can be shipped to the EU. These creates technical barriers for Ghana's exports.

Ghana also faces institutional constraints in meeting these EU requirements (Mensah, 2010; European Commission,2013; Beyens, et al, 2018). This ineffectiveness and corruption among institutions that regulate trade and other economic activities serve as a constraint and occasionally erode the benefits Ghana generates from trade. For instance, in 2013, Ghana was blacklisted by the EU because enforcement of the IUU (Illegal, Unreported Unregulated) regulatory framework was lacking. This led to a 60 percent reduction in the overall tuna exports, reducing foreign exchange earnings significantly (Maale-Adsei, et al, 2015)

The second is the external constraints that have limited Ghana from fully exploiting the opportunities in the EU as well as advancing in the area of technology and agriculture. This is largely as a result of the European Union (EU) strictly enforcing certain rules which do not allow Ghana to increase her market share. This includes the refusal to reduce or eliminate subsidies, especially on agriculture products (Karunanidhi, 2011; Yennu, 2018). This has been a great setback for Ghana because exporters find it difficult to compete with their peers in the developed world (Yennu, 2018). Another is the intermittent embargos on selected agriculture products with the predominant excuse always being low standard levels of products.

Conclusion

From the discussion above, it is obvious Ghana and the European Union have enjoyed favorable trade relations even though there have also been significant challenges that serve as barriers to trade for Ghana.

Chapter Summary

This Chapter summarized Ghana's trade with the EU considering the history, trade agreements, and how those trade agreements have evolved. This chapter also summarized trends in their trade and some of the challenges faced.

CHAPTER THREE

LITERATURE REVIEW

Introduction

This chapter is devoted to relevant issues on the effects of the EU's Environmental Policy Stringency on Ghana's Exports. The theoretical basis for the research questions to be examined is established in the first section. In this section, various theories underpinning the study is discussed. This is followed by the empirical reviewin the second section, thatlook at prior studies related to the subject.

Theoretical Review

This section looks at the existing theories that are relevant to this research. In this context, the Environmental Kuznets Curve, Porter's hypothesis, and the Pollution Haven hypothesis are reviewed along with their essential relationships.

Pollution Haven Hypothesis

The Pollution Haven hypothesis by Copeland and Taylor (1994) which links country income levels and the stringency of environmental regulation to predictions on pollution levels and liberal trade patterns is one of the hotly debated predictions in international economics. The hypothesis proposes a two-country static general equilibrium model of international trade based on a continuum of items distinguished by pollution intensity. The model only has one primary component of production, and it assumes that countries differ primarily in their endowment of human capital. The model is built to reflect three realities: first, global income distribution is extremely unequal; second, industries differ substantially in their pollution intensity of production; and third, environmental quality is a normal good.

It then uses these assumptions to make predictions about trade patterns and pollution levels. The emergence of trade liberalization as an environmental issue became a topic of interest as a result of initiatives such as the North American Free Trade Agreement and the Uruguay Round of GATT negotiations.

The "Pollution Haven Hypothesis" (PHH) has become one of international economics' most contentious and widely debated hypotheses since that time. It is at the heart of the trade and environment issue because it establishes a clear link between disparities in environmental regulation and economic flows between countries. According to the hypothesis, liberalized trade-in products will lead to the migration of pollution-intensive industries from high-income nations with strict environmental regulations to low-income countries with lax environmental regulations (Taylor, 2004). The Hypothesis supports that, strict environmental policies raise the cost of economic activity, incentivizing firms to relocate their manufacturing stages to nations with laxer environmental restrictions.

Environmental quality is a normal good, according to proponents of free trade, hence trade-induced wealth gains should lead to political demands for stricter environmental standards (Copeland & Taylor, 1994). As a result of the higher criteria, cleaner production methods should emerge. Skeptics, on the other hand, argue that if manufacturing practices remain unchanged, pollution will continue to rise as trade expands. If environmental quality is considered a normal good, developing countries will adopt lower environmental requirements. As a result of income disparities around the world, free trade may have an impact on the composition of national output, with many developing countries shifting to more

polluting activities. Empirical Research from Heerings (1993) for example confirms that the phosphate fertilizer industry, for example, has shut down many plants in European countries with high environmental requirements, whereas developing countries, particularly China and Morocco, which do not have such stringent requirements, have rapidly expanded their production of phosphate fertilizers.

Porter Hypothesis

The paradigm that Environmental regulations such as technological standards, environmental taxes, or tradable emissions permit force firms to allocate some inputs (labor, capital) to pollution reduction, which comes at an additional cost, is unproductive from a business perspective and erodes their global competitiveness was challenged by some analysts, notably Professor Michael Porter and his coauthor Claas van der Linde. Porter and Van der Linde (1995) questioned the prevailing concept of static competitiveness and advocated for dynamic competitiveness, which is fueled by increased productivity through innovation rather than low-cost inputs or economies of scale.

They argued, based on case studies, that pollution is usually a waste of resources, and that reducing pollution could contribute to an increase in resource productivity. In some cases, more rigorous but well-designed environmental rules (especially market-based instruments like taxes or cap-and-trade emissions permits) might "spark innovation that may partially or more than fully offset the costs of compliance." (Porter & Linde, 1995).

The Porter Hypothesis is hypothesized in two main ways: weak and strong versions. The weak version of the Porter Hypothesis looks at the relationship between environmental policy and technological innovation, specifically the impact of environmental policy stringency on technological innovation. Simply put, the "weak" form of the PH assumes that well-crafted environmental regulations have a positive impact on environmental innovation. Finally, the "strong" PH claims that environmental regulation-induced innovation could more than cover higher costs, reduce regulatory expenses and, as a result, improve a company's competitiveness and productivity.

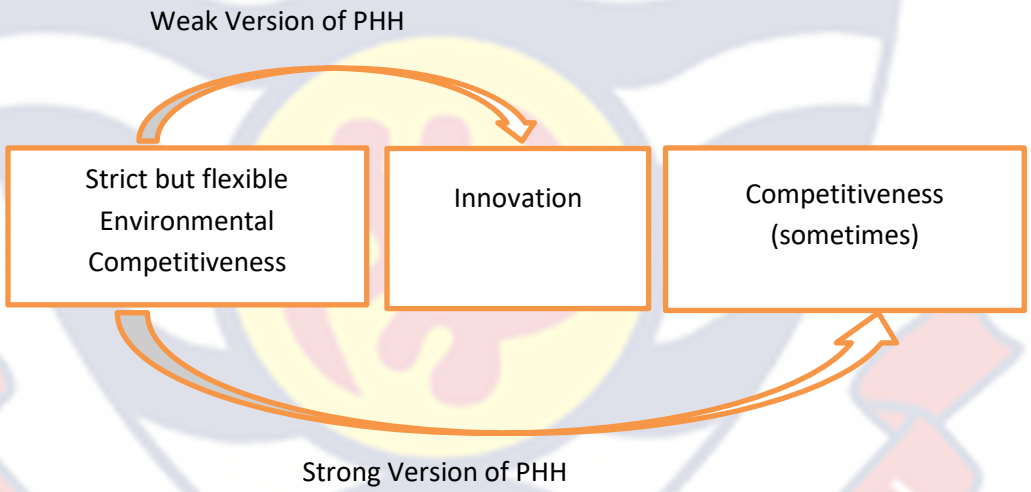

Figure 9: The main causal links involved in the Porter Hypothesis adopted from Lee (2018)

Environmental regulations, as first explained by Porter and van der Linde, can lead to "innovation offsets" that not only increase environmental performance but also partially and sometimes more than fully cover the additional cost of regulation if correctly structured.

Environmental Kuznets curve Hypothesis

Until the 1980s, the dominant environmental philosophy claimed that environmental effects rose in proportion to the size of economic activity and that technology could be chosen to be more or less ecologically friendly (Stern, 2018). Instead, Grossman and Krueger (1991) claimed that increasing growth would improve rather than degrade environmental quality. They used the GEMS database to conduct an empirical examination of the association between ambient pollution levels in various cities throughout the world and per capita income to back up their claim. The concentrations of several contaminants peaked when a country's per capita income reached nearly the same level as Mexico's at the time, according to their study.

This analysis was to respond to Environmentalists' critics of the North American Free Trade agreement who claimed that the economic growth that will emanate from the free trade will destroy the environment of Mexico. The EKC was popularized by the World Bank's World Development Report in 1992, which claimed that "the view that increased economic activity inevitably harms the environment is based on static assumptions about technology, tastes, and environmental investments," and that "as incomes rise, the demand for improvements in environmental quality will rise, as will the resources available for investment.".

Simply explained, the environmental Kuznets curve (EKC) is a theoretical link between several environmental indices and per capita GDP. Pollution emissions rise and environmental quality fall in the early stages of economic

expansion, but as income per capita reaches a certain threshold (which varies depending on the indicator), the pattern reverses, and economic growth leads to environmental improvement. This means that environmental damages or emissions per capita are inverted U-shaped functions of per capita income. Thus, in the early stages of economic development, environmental awareness is limited or non-existent, and environmentally friendly technology is not available. Environmental deterioration rises in tandem with rising income until a point is reached beyond which, as per capita income rises, the quality of the environment improves.

Although proponents of the EKC have presented some empirical evidence indicating that rising income levels in developing countries can be beneficial rather than harmful to the environment, there have been several arguments and empirical evidence demonstrating that the EKC hypothesis does not reflect real-world outcomes and that there is no guarantee that economic growth will lead to a better environment. Given that income is supposed to be an exogenous quantity, a significant criticism of the EKC model, as articulated in the World Development Report 1992 and elsewhere, is that it implies that there is no feedback from environmental harm to economic productivity.

The premise is that environmental damage does not substantially reduce economic activity to halt the growth process and that any irreversibility is not severe enough to reduce future income levels. In other words, there is the assumption that the economy is sustainable always which is a major flaw. Also, recent Developments at the global level have challenged the theoretical as the EKC

proposed. The pace of reduction in the number and diversity of vertebrate species residing in terrestrial, marine, and freshwater habitats has been reported to increase through time as a result of economic development, and there are no signs of this trend slowing down (Okereke, & Massaquoi, 2017). Some Global Ecosystem Assessment reports have demonstrated that, compared to other periods in human history, the last 50 years have seen significantly more profound human alteration and adverse effects on the natural environment (Seppelt et al., 2011; DeFries et al., 2012).

Some other criticisms also suggest that even if an EKC-like link existed, it may be due in part or entirely to the impact of trade on the distribution of polluting industries. According to the Hecksher–Ohlin trade theory, which is the core theory of trade in modern economics, developing countries will specialize in the production of items that are intensive in the production inputs they have in relative abundance: labor and natural resources, under free trade. Human capital and manufactured capital-intensive activities would be the focus of developed countries. This specialization could explain some of the decreases in environmental degradation in developed countries and some of the rises in environmental degradation in developing countries.

New Institutional Economic Theory

The New Institutional Economic theory (NIE) draws on insights from disciplines, such as sociology, political science, and law, to better understand how institutions operate and how they influence economic outcomes (Kherallah, M., & Kirsten, 2002). The term "New Institutional Economics" was first used by Oliver

Williamson (Coase, 2000), but it is widely accepted that Coase's 1937 article "The Nature of the Firm" marked the beginning of the New Institutional Economics concept (Kherallah, M., & Kirsten, 2002). This piece, along with his other well-known work "The Problem of Social Cost" from 1960, kicked off what many, including North (2000), thought would be an economics revolution. The New Institutional Economic theory (NIE) is a framework that seeks to incorporate a theory of institutions into economics. NIE emphasizes the importance of institutions in shaping economic behavior and outcomes, and it argues that economic behavior cannot be understood in isolation from the institutional context in which it occurs (North,1993). Prior to the development of NIE, traditional neoclassical economics tended to treat institutions as exogenous factors that did not affect economic behavior in any systematic way (North,1993). However, NIE challenges this assumption and argues that institutions are integral to economic behavior. NIE argues that institutions help to reduce uncertainty and transaction costs in economic transactions, allowing individuals and firms to engage in more complex and productive economic activities (North,1993**;** Dugger, 1995). Schmidt-Trenz and Schmidtchen (2006) argues that the New Institutional Theory is applicable in any kind of international business. In the context of export, NIE argues that institutional quality is a key determinant of a country's ability to compete in international markets. Countries with strong institutions are better equipped to overcome the challenges of exporting, such as navigating complex trade regulations and customs procedures, managing supply chains, and accessing finance. As a result, they are more likely to develop successful export-oriented industries.

Review of Concepts

Environmental Policy Stringency

United Nations Environmental Program (UNEP) was established by the United Nations as early as 1972. Since then, the number of environmental agreements under the United Nations' auspices has continuously increased. The European Union has long been a driving force in international environmental negotiations that resulted in the United Nations Framework Convention on Climate Change (UNFCCC) and the Kyoto Protocol (Kyoto Protocol) being signed in 1992 and 1997, respectively (Santi & Latisino, 2015). Since the early 1970s, the EU's environmental policy has been formulated under environmental action programs. The policy has gone through eight phases. Until 2020, Europe's environment strategy was guided by the 7th Environment Action Programme (Living well within the limits of our planet).

The EU's environmental strategy will be guided by the 8th Environment Action Programme (EAP) through 2030. The introduction of the EU Emission Trading Scheme (Directive 2003/87/EC) and the directives of the 2020 Climate and Energy Package on CO2 emission reduction (2009/29/EC, 2009) and renewable energy (2009/28/EC, 2009) are among the most important EU policy interventions. The Environmental Policy Stringency Indicators are the first concrete attempt to quantify environmental policy stringency internationally over a long-time horizon. Alternative proxies of Environmental Policy Stringency employed in the literature, such as measures of perceived stringency based on surveys, measures based on environmental outcomes, and a composite policy-based measure with no time series, show relatively high and significant correlations (OECD,2018).

The OECD Environmental Policy Stringency Index (EPS) is a country-specific and globally comparable measure of environmental policy stringency. The OECD (2016) defined Environmental Policy Stringency Index (EPS) as "the strength of the environmental policy signal – the explicit or implicit cost of environmentally harmful behavior, such as pollution." Botta and Koźluk(2014) also defined it as the degree to which environmental policies put an explicit or implicit price on environmentally harmful behavior. The OECD's environmental policy stringency (EPS) indicator combines data on a variety of environmental policies to produce a composite measure of relative policy stringency over time and between nations (Botta and Kozluk, 2014). It covers 28 countries. Selected environmental policy tools are scored and aggregated into composite EPS indexes, with a focus on climate and air pollution.

The indicator focuses on upstream sectors like energy and transportation, which are both important for the environment and have similar relevance across countries. Environmental taxes, renewable energy, and energy efficiency support (feed-in tariffs, renewable energy certificates, R&D expenditures), performance standards (emission limit values for coal-fired power plants and Sulphur content limits in diesel fuels), and information on deposit and refund schemes are among the policies covered. At the moment, the indicator is largely concerned with air and climate policies. The indicator is graded on a scale of 0 to 6, with 6 denoting the most stringent policies.

Institutional Quality

In contemporary literature, the concept of institutions has gotten a lot of attention. An author like North (1990) has elaborated on the role of institutions in economic performance. The profundity of a regulatory environment lies in the fact that it affects the competitiveness of the economy. This, in turn, determines the behavior of economic agents, thereby bearing on the overall growth of the economy. Most of the theories relating to the regulatory environment assert that, while government regulation of economic activities is crucial, it should be kept minimal. These arguments, however, suggest that the essential role of the state should be the provision of coherent laws that are enforced effectively and impartially, along with the protection of private property rights.

Institutions, according to Schmoller (1900), are habits, ethical principles, practices, and laws that, when linked together, form a system. Commons (1934) defines institutions as collective acts that control individual acts, suggesting that society is made up of individual institutions such as the state, the family, the corporation, and the commercial association among others. Hayek (1967) also defined institutions in the context of social laws that can be separated into two categories. The first class is termed "organization," and it consists of simple principles that do not change, have defined goals, and are purposefully created. The second category is "spontaneous rules," which are complicated rules with no defined goals that are constantly growing and are established in an unintended or unconscious manner.

Furthermore, North (1990) distinguishes between formal (such as rules, laws, and constitutions) and informal (such as standards of conduct, conventions, and self-imposed codes of conduct), saying that formal institutions can change quickly but informal institutions cannot. Almost all the dimensions of institutions reviewed speak significantly to rules and law but the mere existence of rule of law can still lead to bad governance practices if incidences such as the will to quality contract enforcement, enforcement of industry and legal standards, property rights, etc. are absent. From international trade policies that can change the composition and direction of trade and hence, discourage overexploitation of resources that ultimately add to environmental costs by way of increased pollution, to regulatory policies that enhance governance structures for better environmental outcomes during economic activities, the role played by effective governance actors is crucial.

Kaufmann, Kraay, and Mastruzzi (2010) defined governance as the authority exercised by a country's institutions. Governance does not only includes selecting, monitoring, and replacing the governments, but also encompasses the ability to formulate and implement sound policies effectively the governments. Governance, according to UNDP (1997), is also the use of economic, political, and administrative power to manage a country's affairs at all levels. The dimension of World Governance Indicators (WGI) Institutional Qualitywhich captures Control of Corruption, the Effectiveness of the Government, the Rule of Law, and the Absence of Violence or Terrorism, Political Stability and Voice and Accountability is used for this study.

With growing environmental concerns as climate change and biodiversity loss accelerate, governance systems must be responsive.

While technological and economic activity may be the direct source of environmentally destructive conduct, David (1985) andBarley (1986argue that individual attitudes, society norms, and institutions shape the activity's progress. Policymakers and institutions are now the focus of attention, as their decisions on future economic activities are crucial and can have a significant impact on current and future environmental damage (Gök & Sodhi, 2020). Countries with a robust institutional framework are more likely to succeed in enforcing environmental regulations. Dehaghi and Mirhashemi (2014) also acknowledge that countries with well-structured institutional structures can control greenhouse gas emissions.

Institutional Quality and Environmental Policy

The OECD (2008) notes that several governmental organizations are responsible for different parts of the environmental problem and emphasized the need for effective and efficient governments to exist if countries want to find the right balance among environmental, economic, and social policy objectives. Pellegrini and Gerlagh (2006) conducted an empirical study to determine the relative impact of various environmental policy factors. The authors discovered that corruption is a significant and important factor in environmental policies. Mitchell and Pigram(1989) also posits that environmental policy, conservation, and the management of natural resources are a function of appointed officials in the public sector.

Although pollution sometimes crosses national borders and polluters are migratory, Andersson (1991) contends that governments should be able to coordinate sound environmental management. Brief analyses of atmospheric emissions, tropical rainforest destruction, cigarette consumption, multinational corporate development, and the spread of new technologies all point to government failure as a key source of environmental mismanagement (Andersson,1991). Improved government effectiveness improves the efficiency of civil services, which prioritize environmental protection and cleanliness (Gök & Sodhi, 2020). In their work, they make it evident that Governance improvements that lead to the enforcement of environmental policies are witnessed only after a certain level of governance performance is achieved. The current level of economic growth in countries is a significant feature of governance outcomes.

Lower-income countries place a higher priority on governance arrangements that improve economic achievements at the expense of environmental effects but compliance is more likely when rule of law, good governance, and for that matter an effective government prevail. Studies on the influence of corruption on the environment have found a negative correlation between the two, with corruption dampening rule of law and policy compliance (Fredriksson and Mani 2002; Ridzuan et al. 2019; Habib et al. 2020;). On the policy front, they advocate for more transparent laws and severe punishments for corrupt officials and entrepreneurs whose illegal activities encourage noncompliance with environmental regulations. The link between institutions and environmental outcomes has been proven in the literature cited above and supports the conclusion

that institutional settings and the responsiveness of policy makers are related to environmental outcomes.

Institutional Quality and Trade

A solid institutional system is critical for financial and economic progress (Dehaghi & Mirhashemi, 2014). Governments in developing nations can also exert control of markets by instituting well-organized strategies to improve firms' environmental performance (Dasguptaa, Laplantea, & NlanduMamingi, 2001). Over the last few decades, trade literature has emphasized the effects of increased institutional quality on international trade, supporting the premise that better institutions and governments will boost international trade flow (Bilgin, Gozgor, & Demir, 2017).

Anderson and Marcouiller (2002), who argue that the quality of the institutions involved has a positive impact on bilateral trade, strongly also support this hypothesis. Similarly, C.lvareza, Barberoa, Rodrguez-Poseb, and L.Zofo (2018) claim that institutional quality boosts bilateral trade and that this effect grows over time. Institutional development, according to Jalilian, Kirkpatrick, and Parker (2007), reduces information deficiencies, increases economic incentives, and reduces transaction costs. Similarly, Chowdhury and Audretsch (2014) claim that better institutional quality and good governance reduce trade costs and default risks, while Yu, Beugelsdijk, and Haanab (2015) go even further, claiming that better formal and informal institutions facilitate trade.

Environmental Policies and Trade

Environmentalists contend that to overcome serious environmental problems, rapid, often unilateral measures, sometimes involving trade restrictions of some kind, are essential. Environmental problems have been addressed by legislators and governments in a number of methods, including national law and regional and international accords aimed at regulating a problem. This regulation is increasingly affecting trade (Hage & Porges, 1992).

One of the main goals of environmental policy is to encourage innovation in environmentally friendly technology and prepare the road for "green" growth, therefore increasing overall economic activity. Political leaders across advanced and industrialized countries often argue that stringent environmental and climate domestic policies can help local firms achieve technological leadership, thereby boosting the competitiveness of the national economy and creating jobs. These measures may also stimulate innovative activity overseas, strengthening international players in the domestic market (Dechezleprêtre & Glachant, 2013). Indeed, the fact that non-residents filed 44 percent of patent applications globally in 2008 (WIPO 2010) demonstrates that manufacturers and inventors look past national borders.

Per this, foreign environmental measures are likely to increase domestic exports if firms are driven not just by local but also by overseas market circumstances. For example, according to Lee (2018), Korean exports of environmental items grew in nations with more rigorous environmental legislation. Similarly, Lanjouw & Mody (1996) found that tight automobile pollution laws in

the United States appeared to encourage innovation in Japan and Germany. Here, we have an example of one nation's legislation driving innovation in other countries, with more remarkable results than in the regulating country. Despite strict environmental rules, there was an increase in the volume of automobile exports from Japan and Germany to the United States. Other studies that have also shown a positive relationship between strict environmental regulations and economic activities include Brunnermeier & Cohen (2003); Crabb & Johnson (2010); Popp et al. (2011); Kim & Choi (2013).

Empirical Review

The literature on the relationship between trade and the environment has grown since the beginning of the 1970s. The connections between trade and the environment are numerous, complex, and significant, and they have long been contentious topics of discussion. Two strands of related literature are discussed below. The first strand concerns environmental policy on a country's competitiveness and the second strand of literature reviewed considered foreign environmental policy on a country's competitiveness

The link between Pollution abatement costs and trade flows from Mexico and Canada to the USA was examined by Levinson and Taylor (2008). The study developed a simple, multisector, partial equilibrium model, where each manufacturing sector is composed of many heterogeneous industries. The researchers created a simple economic model to show how unobserved heterogeneity, endogeneity, and aggregation difficulties skew assessments of the regulatory costs-trade connection. The study used data on US regulations and net

trade flows between the US, Canada, and Mexico to estimate a reduced form of the model for 130 manufacturing industries from 1977 to 1986. The empirical results from this study showed a positive statistically significant and empirically plausible relationship between Pollution abatement cost and net imports into the US. The study found that a 1% increase in pollution abatement cost predicts a 0.2% increase in net imports from Mexico and a 0.4% increase in net imports from Canada.

The close connection between theory and empirical work is further illustrated by Kellenberg (2009) who studied the effect of environmental policy on the activities of US multinational businesses in 50 countries over the period 1999 to 2003. The study described a simple scenario in which governments' strategic environmental policy choices influence multinational businesses' production decisions. The study design was based on this model: The study utilized the model to construct an estimating equation as well as to suggest the usage of adjacent country characteristics as tools to address potential endogeneity in environmental policy. Using this Instrumental Variable technique, the study discovered that poor environmental legislation is linked to increased activity by US corporations, providing further evidence of the Pollution Haven Hypothesis.

Comparison between Chinese target and non-target cities in terms of strict regulations on sulfur dioxide emissions (two control zone policy) was done by Heringa and Poncet (2014). The authors report that firm exports in target cities (with stricter pollution standards) decreased relative to non-target cities. The strong version of the Porter Hypothesis was studied by Bhanagar and Cohen in 1997, who found that tight environmental regulation has a much greater positive

influence on a country's export performance than it does on productivity performance. They used the 2SLS approach to examine the impacts of strict environmental policy on industry profits and implicitly concluded that not just environmental restrictions, but also the technical breakthroughs induced by regulation, had a favorable impact on industry earnings. As a result, the study concluded that stringent environmental policies do foster environmental innovation.

The influence of environmental policy stringency on factor production was also studied by Lanoie, Patry, and Lajeunesse (2008) in a strong version of the Porter Hypothesis. Their research suggested that stricter environmental policies boost productivity, especially in industries with a lot of international competition. As a result, environmental policy stringency may hasten innovation initiatives, resulting in improved economic performance. The impacts of environmental policy stringency on productivity growth in OECD nations were also examined by Albrizio, Koźluk, and Zipperer in 2014. They estimated a reduced-form model of multi-factor productivity development, where the influence of nations' environmental policies changes with the pollution intensity of the industry and technological advancement, using a novel environmental policy stringency (EPS) index. A multi-layer analysis gives information at three levels: the overall economy, the industry, and the enterprise. One year before the policy change, a negative influence on productivity growth is discovered at the aggregate economy level. Within three years of implementation, the unfavorable "announcement effect" is offset. With increasing distance from the global production frontier, this effect

declines, eventually becoming insignificant at larger distances. Only the most technologically sophisticated enterprises benefit from tighter environmental rules in terms of productivity growth, whereas a third of firms, the less productive ones, suffer a productivity slowdown.

The relationship between environmental regulation and innovation was also looked at by Lanjouw and Mody (1996) in the 1970s and 1980s, a time when public knowledge and concern about environmental change were quickly growing. The study measured environmental pollution regulation with pollution abatement costs. The number of successful environmental-related patent applications granted was used as a proxy for innovation. The unusually high proportion of vehicular air pollution patents granted to German and Japanese inventors in the United States suggested a more effective innovation response in Germany and Japan. This is an example of one nation's legislation driving innovation in other countries, with more remarkable results than in the regulating country.

The high number of vehicles shipped from Japan and Germany to the U.S., many of which were subject to severe environmental rules, seemingly put pressure on German and Japanese automakers and suppliers. The same authors offered additional empirical evidence that demonstrated that within the same period, developing nations' imports of patented ideas and equipment that contained environmental technology were linked to stringent environmental policies in innovative countries. Even though this may not directly indicate innovation in developing countries, it does demonstrate a desire to adopt environmentally friendly industrial methods.

Kopp (2004) also investigated both the invention and dissemination of air pollution control devices using patent data from the United States, Japan, and Germany. The study looked at air pollution control technology flows between the US, Japan, and Germany using patent data. The study looked at the flow of technology aimed at reducing nitrogen oxide (NOX) and sulfur dioxide (SO2) emissions by electric utilities in particular. The purpose of the study was to explore how domestic and international environmental policies impact a country's knowledge stock. As a result, it drew on two distinct bodies of literature. Issues concerning the direct links between domestic environmental policy and domestic innovation, as well as questions about the direct links between international environmental policy and domestic innovation. Overall, the data suggested that innovators respond to domestic environmental regulatory demand but not to international environmental legislation. Poppa, Hafner, and Johnstone (2011) utilized patent data to assess innovation in the pulp and paper industry's elemental chlorine-free (ECF) and completely chlorine-free (TCF) technologies. The report also examines the relationships between national environmental policies and innovation in different nations. The paper finds a link between domestic and international regulation and innovation. However, all these results are based on correlation analysis, which may not give adequate proof of causality. Hence, it is unclear if these findings may be regarded as causality.

The impact of foreign environmental policies on domestic innovation in the Wind sector across OECD nations from 1991 to 2008 also investigated by Dechezleprêtre and Glachant (2013). The yearly increased wind power capacity in

each nation is used as a proxy for the strictness of regulations encouraging demand for wind innovation. The fixed effects approach was used as the estimation methodology. Their findings reveal that increases in wind technology respond positively to both local and international policy, although the marginal effect of domestic policies is 12 times larger.

In a study by Vries and Withagen (2005), they looked at the effect of environmental regulations on innovation for which they experimentally explored this notion across nations by linking environmental stringency to innovation in the field of SO2 abatement – as measured by patents – from 1970 to 2000. Patent applications were used to assess the motivation to innovate. They looked at three distinct environmental stringency models in their research. Increased stringency does not appear to have a positive meaningful effect on innovation in two of these models. However, in the theoretically preferred model, there is a case for what we would like to call the weak version of the Porter hypothesis Their results indicate that there isn't explicit proof that severe environmental policies produce win-win scenarios because patent applications aren't valid metrics of innovation. However, there is evidence that enforcing strong environmental policies on SO2 has resulted in the development of innovative abatement methods Ederington, Levinson, and Minier (2005) discovered a significant influence of pollution abatement costs on trade between developing nations and in pollution-intensive, footloose businesses using data from the United States. The results from their study showed that the US exports more from countries with stricter regulations, which also appears to contradict the pollution haven argument.

On the contrary, evidence from Hyuk-Ki Min (2010) seem to suggest otherwise. The study panel data from 20 European countries, the United States, and Japan from 1995 to 2007. The findings show that Korea's exports to countries with strict environmental rules have declined and that environmental policies have a greater impact on environment-related industries than on total industries. The outcome supports Pollution Haven Hypothesis by demonstrating that a trade partner's environmental policy acts as a trade barrier against items from nations with less stringent environmental policies.

Similarly, a regression analysis by Lee (2018) on the effect of a trade partner's environmental policy stringency using a fixed-effect model reveals a statistically significant positive relationship with Korean environmental goods Per the findings, if the stringency of a trade partner's environmental policy increases by 1%, Korea's export of environmental goods will increase by 0.757 percent of the combined list of environmental goods products, and by 0.923 percent for select core environmental goods (40 products) and 1.025 percent for a more limited list of environmental goods, which included 11 items. To sum it up, his study shows that the environmentally stringent policy of trade partners affects Korea’s Export of environmental goods. This finding suggests that the market for environmental goods grows in countries with tougher environmental policies and that Korea's environmental exports increase when trade partners' environmental policies tighten.

By estimating the gravity model, Shim and Jeong (2009) also explored the influence of importing nations' environmental regulations on Korea and Japan's export flows of renewable energy and energy efficiency technology. The estimation

result supported the Porter hypothesis, according to which environmental regulation is a key source of competitive advantage. Similarly, Kim & Choi (2013) investigated the impact of environmental policy strictness on the export of environmental products in Korea, as well as whether the Porter Hypothesis applies to the export of environmental products in Korea, concluding that strengthening environmental policy improves the environmental industry's competitiveness. According to the findings, the stricter the importing nations' environmental policies are, the more favorable the influence on Korea's environmental goods exports.

The debate on the linkage between environmental standards and competitiveness has relied too heavily on economic models and too little emphasis on political and institutional factors. As previously stated, there is a growing question as to whether strong institutions provide greater benefits from trade through environmental protection policies or not. Thus, even though the economic logic for this direct positive or inverse relationship may be strong, it appears that the extent of the impact of the standards may be because of the degree of institutionalization of political and government support for the standards. Various facets of governance may affect environmental policy (Mitchell 1989; Fredriksson and Mani 2002; Pellegrini and Gerlagh 2006; Ridzuan et al. 2019 Gök and Sodhi 2020; Habib et al. 202). Lee and Choi (2006) found that in 2001, all video game consoles, which were developed by Sony for the EU market, were recalled after they were found to have a Camium level that exceeded the EU environmental quality standards. Not only did this incident cause a direct loss of approximately US$200 million but it also became a bad precedent that result in a loss of the market

share to its rivals such as Microsoft Corporation. This example illustrates that the failure of Japanese institutions to make sure that Sony complies with the host country's environmental regulations can undermine the company's competitiveness in the global marketplace.

Using a theoretical model that generates various testable predictions, Damania, Fredriksson, and List (2003) looked at the connections between trade, corruption, and environmental policy. The study used panel data from a mix of industrialized and developing nations from 1982 to 1992. Their findings revealed that trade openness is positively correlated with the stringency of lead concentration regulations in gasoline, with the relationship being mediated by government corruption. Gamso (2017) also used a dataset comprising 58 Latin American and Sub-Saharan African nations over 10 years (2001–2010) to investigate if strong governance might counteract the negative effects of trade with China on environmental policy outcomes. The tests looked at how two aspects of good governance, representativeness, and bureaucratic competence, moderated the impacts of environmental policy proxies like SO2 intensity and environmental public health. The study used the fixed effects technique to examine the link between trade with China and environmental policies in developing nations, a relationship that is becoming increasingly relevant as China's trade with these countries expands significantly. Even though the results showed some mixed support for governance, some aspects of the findings showed that the bureaucratic capacity of governments in developing countries does moderate the environmental policy impact of their trade with China.

In a related line of research, Joo, Seo, & Min (2018) conducted an empirical study that examined the causal relationship between government intervention for the firm's environmental sustainability and their export performance using a survey questionnaire comprising of questions that were related to government intervention that can motivate both environmental and technological innovation capabilities. The study adopted the Structural equation Model for its analysis. Their findings found that government intervention helped a firm improve its environmental and innovation capabilities. The study also discovered that the firm's environmental and technological innovation capabilities improved the firm's environmental and export performance. In other words, the government's intervention improved the firm's environmental policy compliance, increased innovation capabilities which positively affect export performance, and put firms in a better position to comply with international environmental regulations. The study also indicated that certain government intervention measures had a stronger impact on a firm's adherence to environmental policy and export performance than others. In general, the literature from Lee and Choi (2006), Damania, Fredriksson, and List (2003), Gamso (2017), and Joo, Seo, & Min (2018) seems to support the idea that the government, political authorities, or institutions of the host country must provide some support for compliance with stricter market policies, whether they are in other countries or the host country. Politicians and institutions which advocate for more stringent environmental policy often argue that such policy spurs innovation and enhances competitiveness. One conventional way of interpreting this statement in this

context is that environmental policy in the face of effective institutions and systems stimulates the emergence of new, competitive, and profitable export opportunities.

Chapter Summary

In this chapter, three theories were discussed: the Pollution Haven theory, the Porter hypothesis, and the Environmental Kuznets curve hypothesis. The study went on to review the main concepts of the study and explain how they are related. Finally, the study reviewed the major empirical literature related to the work, taking into account the methodology and major findings.

CHAPTER FOUR

RESEARCH METHODS

Introduction

The purpose of this chapter is to present the study's methodology. The order of the presentation is as follows: The chapter first presents the research design and a brief overview of the linear panel Fixed, and the Random Effect model in the estimation of export potential, followed by the traditional gravity model and its weaknesses. It then presents an overview of the theoretical foundations of the stochastic Frontier Gravity Model. Model specification justification and measurement of the variables, sources of data, estimation techniques, and post-estimation tests are presented after this. The chapter finally presents a discussion of the major econometric issues regarding panel regression estimated.

Research Design

In line with the objectives of the study to estimate the effect of the EU's environmental policy stringency on Ghana's bilateral export, and examine the effect of institutional quality on Ghana's bilateral export the study adopted the positivist philosophy. Positivists believe that social reality is stable and, as a result, can be seen and described objectively without interfering with the phenomena under investigation. As a result, positivist philosophy allows researchers to investigate social and economic processes objectively while also explaining relationships between variables. For the building of mathematical models to analyze the link between quantitative measures, positivist philosophy is applicable. Based on the positivist ideology, the quantitative approach was used in this study.

Utilizing a quantitative research design offers several advantages, such as enhancing objectivity, facilitating generalization of findings, and enabling the replication of results by other researchers. In this particular study, an explanatory research approach was adopted within the quantitative framework, given the aim to provide explanations. By employing an explanatory design, the researcher gains the ability to determine the extent and characteristics of cause-and-effect relationships. The selection of an explanatory research design aligns with the overall objective of the study, as it offers the most suitable approach to conducting the research.

Theoretical Model Specification

This section begins with a brief discussion of the traditional gravity model and then moves on to discuss its weakness for determining trade flows. The strength of the Stochastic frontier models over the traditional gravity model is then presented, followed by the theoretical formulation of the stochastic frontier models, and the empirical specification of stochastic frontier gravity models.

The Gravity Models

The traditional gravity model is based on Isaac Newton's 1687 law of universal gravitation in physics, which explained the gravitational force between two masses in relation to the distance that separates them that is,

$$F_{ij} = G\frac{M_I M_j}{d_{ij}^2} \qquad (1)$$

The gravitational force F_{ij} is proportional to the product of the two masses M_i and M_j and inversely proportional to the square of the distance d_{ij} that keeps the two masses apart from each other. G is an empirically determined gravitational constant.

As referenced by Deluna Jr and Cruz (2014), Starck (2012) posits that this relationship applies to any context where the modeling of flows or movements is demanded. The gravity model was first applied by Timbergen (1962) to estimate international trade flows. Econometrically, the basic equation is specified as follows:

$$Expt_{ik} = \theta \left[\frac{(GDP_i^{\vartheta} GDP_k^{\delta})}{Dist_{ik}^{\varphi}} \right] \quad (2)$$

where EXP_{ij} refers to the bilateral exports from country I to country j; GDP_i refers to the size of country i; GDP_j refers to the size of country j; D_{ij} refers to the distance between the two countries; α is a factor of proportionality; β, δ, μ are elasticities. Expressed in logarithms, Equation (2) becomes;

$$\log Expt_{ikt} = \ln \theta + \vartheta \ln GDP_{it} + \delta \ln GDP_{jt} - \varphi \ln DIST_{ikt} + \varepsilon_{ijt} \quad (3)$$

ln is the natural logarithm operator; ε_{ijt} is the error term; and t refers to time.

However, the conventional model operates under the assumption of a frictionless environment, disregarding most objective resistances. These resistances are instead aggregated into an unobserved disturbance term, while subjective resistances remain uncontrolled. Consequently, the traditional gravity model may not provide an accurate estimation of trade potential, as it focuses on the perceived maximum possible value rather than the average value. To overcome the limitations of the traditional gravity model and obtain a more precise assessment of trade potential and performance, the stochastic frontier approach (SFA)was introduced.

By incorporating SFA into the conventional gravity model, the error term is divided into two components: a non-negative term that captures production inefficiencies and a conventional symmetric error term that accounts for random disturbances.

The Stochastic Frontier Gravity Model

The Stochastic Frontier Production Function (SFPF) has been widely discussed in the literature on productivity and efficiency. It was independently developed by Aigner et al. in 1977 and Meeusen and Van den Broeck in the same year. This function is used to determine the maximum output achievable from a specific input and technology level, incorporating a structural component of the production function and a decomposed disturbance term. To overcome the limitations of the conventional gravity trade model and to estimate potential trade flows between countries, a hybrid model called the Stochastic Frontier Gravity Model was introduced. Originally credited to Kalirajan in 2000, this model combines elements of both the conventional Gravity Model and the Stochastic Frontier Production Function Model. It is formulated as follows:

$$y_{it} = f(x_{it};\beta) + v_{it} - u_{it}\,,\ i=1,2,\ldots\ldots,n.;t=1,\ldots\ldots,T_i \qquad (4)$$

In the model, denote y_{it} is denoted as the natural logarithm of the output of firm i at time t. x_{it}represents the natural logarithm of the inputs of firm i at time t, forming a vector. β is an unknown parameter vector, and $f(.)$ denotes a well-known production frontier function such as Cobb-Douglas or Translog. The term v_{it}refers to a symmetrical random disturbance that encompasses uncontrollable factors affecting the firm, such as weather conditions, topography, and machine

performance. Similarly, u_{it} represents a non-negative disturbance representing technical inefficiency.

It assumed that v_{it} follows an independent and identically distributed normal distribution with a mean of zero and variance ${\sigma_v}^2$. Similarly, u_{it} follows an independent and identically distributed half-normal distribution denoted as $N^+(0, {\sigma_u}^2)$. It is important to note that v_{it}t and $u_{it}$are independent of $x_{it}$and each other. Equation (4) indicates that u_{it} equals zero when the firm operates at maximum efficiency, implying the absence of production inefficiencies. Conversely, any positive value of u_{it} suggests that the firm operates below the production frontier, indicating the presence of productive inefficiency within the firm's production process.

When a firm is operating at the frontier, it achieves economic efficiency, which is a combination of technical and allocative efficiency (Kalirajan and Shand, 1999). Similarly, it can be argued that a country trades most efficiently when it reaches its trade potential or operates at the forefront of trade. Export potential refers to the highest possible value of exports that could hypothetically be achieved by implementing the most open and efficient trade policies (Deluna Jr & Cruz, 2014). In light of this, it is assumed that Ghana, as an exporting country, exhibits high efficiency without significant constraints behind its borders. To investigate this, the study adopts a modified version of Armstrong's (2007) stochastic frontier gravity model. This involves estimating the trade frontier. Trade resistances between countries i and j are specified in equation (5).

$$TR_{ij} = f\left(dist_{ij},\ other\ factors\right) \qquad (5)$$

Natural resistances are barriers to trade that are not policy-oriented whereas man-made trade barriers are instituted for policy. By including both the natural and manmade resistances, equation 5 can be rewritten as

$$TR_{ij} = f(trade\ resist_{ij}) = p(natural_{ij})q(manmade_{ij}) \quad (6)$$

Equation (6) is further decomposed into man-made and natural resistances in equations (6) and (7), respectively

$$p(natural_{ij}) = RDist_{ij}^{\varphi_1} exp(landlocked_{ij}^{\varphi_2} \dots) \quad (6)$$

$$q(Manmade_{ij}) = q(\ macro\ variabes, institutions, EPS_j\ \dots) \quad (7)$$

Where $RDist_{ij}$ is the relative distance between countries i and j, $landlocked$ is a dummy with a value of one if the country is landlocked, macro variables are economic variables like exchange rates and inflation rates which either hinder of promotes trade, institutions represent the quality of institutions in facilitating and enforcing trade rules and standards and EPS captures the Environmental Policy Stringency of the European Union members.

Taking the log of equation (7) yields:

$$lnTR_{ij} = lnp(natural) + lnq(manmade) \quad (8)$$

Equation (8) captures all the trade resistances between country i and country j. The standard gravity equation proposed by Armstrong (2007) is given:

$$lnTr_{ijt} = \psi_0 + \psi_1 lnx_{it} + \psi_2 lnx_{jt} + \psi_3 lnb(natural) + \sum_m \psi_m lnk_m + \delta_{ijt} - u_{ij} \quad (9)$$

Where Tr_{ijt} is the value of the trade flow from country i to country j at time t, $x_{it}(x_{jt})$, represent the national incomes (GDPs) for i and j at time t respectively, $k's$ are the other determinants of trade and δ_{ijt} is the conventional double-sided error term and u_{ij} is the one-sided error term.

Empirical Model Specification

Using Armstrong's (2007) methodology, the stochastic frontier gravity model in equation (9) can be rewritten as equation (10) to assess the determinants of Ghana's bilateral export flows.

$$lnBEXP_{ijt} = \beta_o + \beta_1 lnGDPM_{it} + \beta_2 lnGDPM_{jt} + \beta_3 lnPOP_{it} + \beta_4 lnPOP_{jt} + \beta_5 lnDIST_{ij} - u_{ij} + v_{ij} \quad (10)$$

Where $lnBEXP_{ijt}$ is the logarithm of the bilateral export flows to each of the 17 trading partners. $lnGDPM_{jt}$ and $\beta_1 lnGDPM_{it}$ are the logarithm of the value of the gross domestic product of the exporting and importing country respectively at time t. $lnPOP_{jt}$, is the logarithm of the total population of the trading partner and $lnPOP_{it}$ is the total population of Ghana. $lnDIST_{ij}$, represents the logarithm of the absolute distance between the capital cities of bilateral trading partners. u_{ij} is a single-sided error for the combined effects of inherent economic distance bias or "behind the border", constraints, which is specific to the exporting country with respect to the particular importing country, which creates the difference between actual and potential bilateral trade. Lastly, v_{ij} is the conventional error term that controls statistical errors and omitted variables.

The objectives of the study are achieved in three ways; First, Model (11) tests the effect of the EU's environmental policy stringency on Ghana's bilateral

exports. Second, Model (12) the effect of institutional quality on Ghana's bilateral export. Lastly, Model (13) the joint effect of the EU's environmental policy stringency and Ghana's institutional quality on Ghana's bilateral exports. The exact formulation of the three models is as follows:

The primary goal is to investigate the effect of the EU's environmental policy stringency on Ghana's bilateral export flows to the EU. Equation (11) below will be used as a baseline regression model to examine the effect of the EU's environmental policy stringency on the bilateral exports of Ghana.

$$lnBEXP_{ijt} = \beta_o + \beta_1 EPS_j + \beta_2 lnGDPM_{it} + \beta_3 lnGDPM_{jt} + \beta_4 lnPOP_{it} + \beta_5 lnPOP_{jt} + \beta_6 lnDIST_{ij} + \beta_7 Landlocked_j + \beta_8 EXR_j + \beta_9 INFRAS_i + \beta_{10} Comoncol_{ijt} + \beta_{11} Comonlang_{ijt} + \beta_{12} TFR_{ijt} + \beta_{13} credit_{it} - u_{ij} + v_{ij} \quad (11)$$

Equation (12) will be used to examine the effect of Ghana's institutional quality on Ghana's bilateral export. It will be useful to understand how the inclusion of institutional quality affects Ghana's bilateral exports for better interpretation. As a result, Equation (12) uses an average value of the six WGI indicators (Control of Corruption, the Effectiveness of the Government, the Rule of Law, and the Absence of Violence or Terrorism, Political Stability and Voice and Accountability) as a proxy for country-level institutional quality. According to earlier research, a country's institutional quality is a major predictor of every economic activity.

$$lnBEXP_{ijt} = \beta_o + \beta_1 INST_i + \beta_2 lnGDPM_{it} + \beta_3 lnGDPM_{jt} + \beta_4 lnPOP_{it} + \beta_5 lnPOP_{jt} + \beta_6 lnDIST_{ij} + \beta_7 Landlocked_j +$$

$\beta_8 EXR_j + \beta_9 INF_i + \beta_{10} INFRAS_i +$

$\beta_{11} Comoncol_{ijt} + \beta_{12} Comonlang_{ijt} + \beta_{13} TFR_{ijt} + \beta_{14} credit_{it} - u_{ij} +$

v_{ij} (12)

Finally, equation (13) the joint effect of the EU's environmental policy stringency and Ghana's institutional quality on Ghana's bilateral exports.

$lnBEXP_{ijt} = \beta_o + \beta_1 EPS_j + \beta_2 INST_j + \beta_3 (EPS_j * INS_i) + \beta_4 lnGDPM_{it} +$

$\beta_5 lnGDPM_{jt} + \beta_6 lnPOP_{it} + \beta_7 lnPOP_{jt} + \beta_8 lnDIST_{ij} + \beta_9 Landlocked_j +$

$\beta_{10} EXR_j + \beta_{11} INF_i + \beta_{12} INFRAS_i \beta_{13} Comoncol_{ijt} + \beta_{14} Comonlang_{ijt} +$

$+ \beta_{15} TFR_{ijt} + \beta_{16} credit_{it} - u_{ij} + v_{ij}$ (13)

Measurement and Justification of Variables

In assessing Ghana's Bilateral Export potential and the gap with its trading partners, the study made use of annual data over the period 1990 to 2019. The variables include bilateral export to the trading partners ($BEXP_{ijt}$), Gross Domestic Product for both exporting and importing countries ($GDPX_{it}$ and $GDPM_{jt}$), the population of the exporting and importing country (Pop_{it} and Pop_{jt}), the distance between the exporting and importing country ($Dist_{ijt}$), landlocked of the importing country ($landlocked_j$), the Exchange rate of the exporting country (ER_i), the Inflation rate of the exporting country (INF_i) Environmental policy stringency for the importing country (EPS_{jt}), Institutional quality for the exporting country (INS_i), Trade Freedom index for importing country (TRF_j), Common colony between the exporting and the importing country ($Comcol_{ij}$). The common official language between the exporting and the importing country ($Comonlang_{ij}$).

Internal infrastructure for the exporting country (Ghana) ($INFRAS_{it}$), Domestic credit to the private sector of the exporting country ($Credit_{it}$).

Dependent Variable

The measurement of this variable involves assessing the overall worth of Ghana's exports to a particular trading ally during a given period, typically denominated in US dollars. Additionally, it encompasses the total value of imports by said trading partners from Ghana. In essence, this encompasses the combined value of goods exported by different regions within Ghana to their respective trading partners. The data pertaining to bilateral exports is derived from the Direction of Trade Statistics (DOTS) provided by the International Monetary Fund.

Independent Variables

The key focal point in the gravity equation revolves around Gross Domestic Product (GDP) for both the exporting and importing nations. Nevertheless, this study incorporates additional factors as control variables, including the population of the importing countries, the distance separating the exporting and importing nations, and the landlocked status of the importing country. Within the model, the primary variables under scrutiny are the European Union's (EU) environmental Policy Stringency and the institutional quality of Ghana, aiming to assess their impact. Other control variables include common colony, official language, infrastructure, credit to the private sector, exchange rate, and inflation rate.

Gross Domestic Product (GDP)

The gross domestic product (GDP) represents the total worth of all products and services manufactured within a country during a specific timeframe, typically one year. To measure the economic output per person, the study employs GDP per

capita at constant prices of 2015, obtained by dividing the GDP by the population count at the midpoint of the year. GDP encompasses the sum of value added by all domestic producers, including product taxes and excluding subsidies that are not accounted for in the product's value. This calculation does not deduct the depreciation of constructed assets or the depletion and deterioration of natural resources. GDP is used to represent the size of the country's economy. Hence all other things being bilateral exports is expected to be proportional to sizes of the country (Chaney, 2018). Data are in US dollars. GDP is expected to have a positive coefficient.

Population *(POP)*

The population refers to the overall number of individuals residing in a specific country, regardless of their legal status or citizenship. It excludes refugees who have not permanently settled in the country of refuge. For the estimation in this study, the total population of the chosen trading partner was utilized. The population serves as an indicator of the economic size of both the importing and exporting nations. The existing theoretical literature presents differing views on the expected coefficient of this variable within the gravity trade equation. Mehanna (2003) suggested a positive correlation, indicating that a larger population in the importing country facilitates trade. On the other hand, Nuroglu (2010) interpreted a negative correlation, suggesting that a higher population may lead to a decrease in per capita income, reducing the need for imports and the level of exports. Consequently, both a positive and negative coefficient are anticipated between the population of Ghana, its trading partners, and bilateral exports. The population data

was sourced from the World Development Indicators (WDI) and is measured in millions.

Distance ($Dist_{ijt}$)

In this study, a time-invariant variable is utilized to gauge the geographical separation between Ghana's capital city (i) and the chosen trading partners (j), measured in kilometers (km). Distance serves as a proxy for transportation costs and is calculated using the great circle formula, incorporating longitudes and latitudes of central locations to determine the weighted distance measure. A negative coefficient is expected for the distance variable, as greater geographic distances between trading partners tend to result in higher transportation expenses. This finding aligns with the research conducted by Roperto (2013), Didia et al. (2015), and Baah (2015). The data for the distance variable is sourced from the CEPII gravity database, specifically the section on distance measurement.

Landlocked ($Landlocked_j$)

The variable under consideration is a dummy variable. Its value is set to 1 when referring to country j being landlocked, and 0 otherwise. The coefficient associated with this landlocked variable is anticipated to be negative. The rationale behind this expectation lies in the fact that landlocked nations tend to engage in less trade due to the increased expenses involved in transporting goods from neighboring countries with accessible ports. Consequently, a negative coefficient is anticipated.

Environmental Policy Stringency (EPS_j)

The EPS index, developed by the OECD, is a comprehensive measure of environmental stringency in various OECD countries. It assesses the extent of environmental regulations and policies in a range of sectors, particularly energy and

transport. This index employs a scoring system from 0 to 6, where a higher score indicates more rigorous policies. All the components of the index are based on legal provisions, ensuring consistency and relevance across countries. The index combines different environmental policy tools, including market-based mechanisms like taxes, trading schemes, and Feed-in-tariffs, as well as non-market-based instruments like standards and R&D subsidies. Equal scoring and weighting are used to aggregate these policy instruments. As illustrated by the Porter and pollution haven hypothesis, the theoretical relationship between policy stringency and trade could be positive or negative depending on other socio-economic factors and practices. Hence the coefficient can be negative or positive. If the coefficient is positive, it means stringent environmental regulations in the foreign country encourage innovation, which boosts exports. However, when it's negative, it signifies that the strict foreign environmental regulations raise the cost of compliance, hence hihindering xports. Data for the Environmental Policy Stringency is sourced from the OECD database.

Institutional Quality (INS_i)

Institutional Quality is proxied by the average of the WGI indicators on institutional quality. These include the Control of Corruption, the Effectiveness of the Government, the Rule of Law, and the Absence of Violence or Terrorism, Political Stability and Voice and Accountability**.** The World Governance Indicators estimate gives the country's score on the aggregate indicator, in units of standard normal distribution, i.e. ranging from approximately -2.5 to 2.5. From the literature, a good Institutional quality framework strongly supports improve trade (Chowdhury and Audretsch (2014); Yu, Beugelsdijk, & Haanab (2015); Bilgin,

Gozgor, & Demir (2017); C.lvareza, Barberoa, Rodrguez-Poseb, and Zofo (2018)). Hence a positive coefficient is expected. Data on government effectiveness variable was sourced from the World Governance Indicators database (WGI).

Exchange Rate (EXR_i)

Exchange rate is simply the value of an exporter's currency for the purposes of conversion to another in this context. The nominal exchange rate is used which refers to the exchange rate determined by national authorities or to the rate determined in the legally sanctioned exchange market. It is calculated as an annual average based on monthly averages (local currency units relative to the U.S. dollar). Standard theoretical models predict that currency changes pass through into consumer prices. Theoretically, the depreciation of a local currency is good for the export sector, ceteris paribus. It would increase the competitiveness of export goods in foreign markets. However, it is only possible when the sum of the elasticities of demand for export commodities and demand for import goods is greater than unity. Thus, the notion that devaluation stimulates exports and curtails import is not always acceptable in all circumstances as can be seen in Abeysinghe and Yeok (1998). Hence a negative or positive coefficient is expected. Official exchange rate data was sourced from the World Development Indicators (WDI).

Inflation Rate (INF_i)

Inflation refers to a continuous upward trend in the general price level of goods and services within an economy. The measurement of inflation can be observed through the annual growth rate of the GDP implicit deflator, which indicates the pace of price fluctuations across the entire economy. The GDP implicit deflator is derived by comparing the GDP in current local currency to the GDP in

constant local currency. Consequently, inflation results in a reduction in the purchasing power of a currency used within the economy, particularly for importers. Hence a negative coefficient is expected. Inflation data was sourced from the World Development Indicators (WDI).

Common colony ($Comcol_{ijt}$)

The variable used in this context is a dummy variable. It takes the value of 1 when there is a colonial tie between countries i and j, and 0 otherwise. The anticipated outcome for this variable is a positive coefficient. This expectation arises from the observation that countries sharing colonial ties generally encounter fewer obstacles in trade, which enables them to engage in higher levels of importation from their trading partners. Therefore, a positive coefficient is expected in this case. The data used for this analysis is obtained from the CEP II gravity database.

Trade Freedom index (TRF_j)

The trade freedom index of the importing country, represents a comprehensive measurement of the presence or absence of barriers, including both tariffs and non-tariff restrictions, that impact the import and export of goods and services in a given country. This index is designed to assess the level of openness exhibited by trading partners in terms of facilitating the global flow of goods and services, as well as the ability of individuals to freely engage in buying and selling activities within the international marketplace. Spanning from 0 to 100, the index indicates the extent to which a country restricts trade. A score of 100 signifies a favorable environment for exports, as it reflects the absence of tariffs and non-tariff barriers. Consequently, a positive coefficient is anticipated. The data on trade

freedom utilized in this study is derived from the World Heritage Foundation's database.

Infrastructure ($INFRAS_{it}$)

The concept of internal infrastructure in exporting countries like Ghana encompasses various transportation systems such as roads, streets, highways, rail lines, airports, airways, ports, harbors, waterways, and other transit systems. These infrastructure elements play a crucial role in facilitating the movement of goods and enabling people to access both domestic and international markets. To gauge the quality of internal infrastructure, one can examine the proportion of paved roads among the total road network. A higher rating in this regard indicates a more favorable infrastructure condition. A well-developed infrastructure is expected to contribute to increased trade and subsequently lead to a rise in exports from Ghana. As a result, Ghana's bilateral export inefficiencies should decrease. Therefore, it is anticipated that the coefficient associated with infrastructure quality would be negative in this context. The data on the percentage of paved roads in Ghana was obtained from the World Bank's World Development Indicators online database, serving as a reliable source for this information.

Domestic Credit to Private Sector ($Credit_{it}$),

Domestic credit allocated to the private sector pertains to the financial resources extended to private entities, encompassing loans, non-equity securities acquisitions, trade credits, and outstanding receivables. These resources establish an obligation for repayment and are measured as a percentage of the country's GDP. The correlation between domestic credit to the private sector and a country's exports appears to be favorable. A larger proportion of domestic credit allocated to the

private sector enhances the financial capabilities of individuals and businesses, enabling them to engage in greater international trade. Facilitating the alleviation of credit constraints can thus contribute positively to the expansion of export activities. Hence a negative coefficient is expected. Data on domestic credit to the private sector in Ghana was sourced from the World Bank, World Development Indicators online database.

Estimation Technique

The study employed the Maximum Likelihood Estimation (MLE) technique, which was previously introduced by Aigner et al. (1977), in order to assess the effects of "behind the border" limitations on prospective exports and estimate the stochastic frontier model.

In this study, the Stochastic Frontier Gravity Model (SFGM) is estimated using the Maximum Likelihood Estimation (MLE) technique, which is known for its superior performance in SFGM estimation. Theoretical principles indicate that the trade potential should represent the highest level of trade flow, necessitating the estimation of upper limits for the data. By employing the Maximum Likelihood Estimation technique, the SFGM is more suitable for this study compared to the conventional gravity model that relies on the Ordinary Least Squares (OLS) technique. The results indicate that the Maximum Likelihood Estimation method significantly outperforms the Corrected Ordinary Least Squares (COLS) method, particularly in cases where the total variance is greatly influenced by inefficiency effects. Therefore, the preferred estimation technique for this study is the Maximum Likelihood Estimation method, as suggested by Coelli, Rao, and Battese (1998).

The decision to utilize the panel data estimation method in this research stems primarily from the bilateral nature of the study. The precision in handling individual heterogeneity, through the incorporation of time-invariant variables and specific effects, further justifies the selection of panel data estimation. Additionally, the utilization of this technique yields informative and efficient data, reduces correlation between variables, and offers greater flexibility by combining time-series and cross-sectional observations. Ultimately, the panel data estimation technique is favored for examining dynamic changes in the study.

Post-estimation Techniques

By utilizing the joint density functions of u_{ij} and v_{ij},, the study will employ the method of maximum likelihood estimation to approximate the coefficients $\beta_o \ldots \beta_{13}$. This estimation will also encompass the determination of the total variance and the parameter γ. The parameter γ represents the ratio of the variance of 'behind the border' constraints to the overall variance of exports, as stated in equation (14).

$$\gamma = \frac{{\sigma_u}^2}{({\sigma_u}^2+{\sigma_v}^2)} \quad (14)$$

In examining the extent of variation in potential export, the gamma coefficient plays a crucial role. Its purpose is to gauge the overall fluctuations in export, attributing them to the influence of socio-political-institutional factors. Consequently, γ serves as an indicator of whether the restrictions within Ghana's borders significantly contribute to bilateral export, while also functioning as a test to evaluate the reliability of the stochastic frontier gravity model presented in equation (10). A noteworthy outcome arises when γ exhibits significance, as it

suggests that the constraints within the borders play a vital role in shaping Ghana's exports. In simpler terms, a significant gamma value highlights the impact of behind-the-border restrictions as the underlying cause for the disparity between potential and actual export.

In addition to the gamma as a robustness test, Kumbhakar, Wang, & Horncastle (2015), indicated that we conduct a likelihood ratio test in which we estimate two models $L(H_0)$ and $L(H_1)$. Where $L(H_0)$ represents an unrestricted model which is strictly Cobb Douglas and $L(H_1)$ is the restricted model.

In light of Kumbhakar et al.'s suggestions (2015), a sequence of formal hypothesis tests is performed to ascertain the distribution of the random variables connected to technical inefficiency and the residual error term. These tests involve imposing restrictions on the model and utilizing the generalized likelihood-ratio statistic (λ) to evaluate the significance of these restrictions. The generalized likelihood ratio statistic (λ) is mathematically defined as:

$$\lambda = -2\{ln[L(H_o)] - ln[L(H_1)]\} \quad (11)$$

Where $[L(H_o)]$ and $[L(H_1)]$ are the values of the log-likelihood function for the frontier model under the null and alternative hypotheses, H_O; there are no technical inefficiencies, and H_1: there are technical inefficiencies. If the null hypothesis involves $\gamma = 0$, indicating that the technical inefficiency effects are not present in the model, then, λ has mixed chi-square distribution with the number of degrees of freedom given by the number of restrictions imposed because $\gamma = 0$ is a value on the boundary of the parameter space for γ (Battese & Coelli, 1992).

Chapter Summary

In summary, the positivist philosophy serves as the underlying framework for the research design employed in this study. In relation to this, the development of both theoretical and empirical models took place. The chapter has provided a concise explanation of the theoretical underpinnings and rationale behind employing the gravity model to analyze international trade patterns. Additionally, the study adopted the stochastic frontier gravity model, recognized for its utility in examining trade flows between nations.

CHAPTER FIVE

RESULTS AND DISCUSSION

Introduction

This chapter presents the empirical results and discussions. The chapter is divided into three sections: the first section presents and discusses the results of the SFGM pertaining to the effects of the EU's environmental policy stringency on Ghana's bilateral export using the Maximum Likelihood Estimation (MLE). The second section presents the effects of institutional quality on Ghana's bilateral export. Finally, the last section presents the joint effect of the EU's environmental policy stringency and Ghana's institutional quality on Ghana's bilateral export. These estimations are in relation to the objectives and hypothesis of the study.

Descriptive Statistics

This part of the study discusses the basic statistical results of the non-binary variables in the study for the specified time frame of the research (1990 to 2019). The descriptive statistics includes various measures such as the mean, minimum (min), maximum (max), and standard deviation (Std. Dev). The mean represents the average value of the variables, while the standard deviation measures the extent of dispersion or proximity of values to the mean. Additionally, the maximum and minimum values signify the range encompassing the values utilized in the study.

Table 1: Summary Statistics of Variables

Variables	Mean	Std. Dev	Min	Max
Bilateral Export	87400000	205000000	114	1720000000
GDP per capita of Exporter	1261.8060	372.1091	856.8901	2053.587
GDP per capita of Importer	34377.4500	15379.0200	4744.0880	76005.2300
Population of Exporter	21989606	4681717	14773274	30417858
Population of Importer	25905072	25064954	3513974	83092962
Distance	5121.1820	675.4850	3650.9530	6101.9740
Environmental Policy Stringency of Importer (EU)	2.2530	1.0000	.1400	4.7200
Institutional Quality of Exporter	-.0607	.1090	-.2810	.1600
Exchange Rate of Exporter	1.3910	1.4970	. 0330	5.2170
Inflation of Exporter	23.9120	14.9540	8.4810	80.7550
Infrastructure of Exporter	29.9690	13.9360	5.0000	60.0000
Trade Freedom of Importer	81.0110	6.4880	49.6000	89.4000
Domestic Credit of Exporter	11.3880	3.9860	3.6570	16.7000

Source: Author's calculation (2022)

From Table 1, the discussion of the summary statistics will cover the period under study. The total bilateral exports from Ghana to the European Union averaged approximately US$ 87400000 with a minimum value of US$ 114 and a maximum value of US$ 1720000000. This implies that from the bilateral export flows;

Ghana's highest earnings under the period of study averaged US$ 1720000000, while lower earnings were about US$ 114 million. The GDP per capita of Ghana and members of the European Union averaged US$ 1261.806 million and US$ 34377.45 million respectively. The maximum GDP per capita of Ghana and members of the European Union are US$ 2053.587 million and US$ 76005.23 million respectively while the minimum values are also US$ 856.8901 million and 4744.088 million. Ghana's population over the period has averaged 21989606 with a minimum value of 14773274 and a maximum value of 30417858. Also, the EU's population over the period has averaged 25905072 with a minimum value of 3513974 and a maximum value of 83092962. Export of Ghana traveled on an average distance of 5121.182 km to EU member countries with the highest distance traveled being 6101.974 and the lowest distance traveled being 3650.953.

The average Environmental policy stringency index of the EU over the period is 2.254 with the highest and lowest being 4.72 and 0.14 respectively. Institutional quality in Ghana was recorded to be -.106 on average, indicating weak institutional structures in Ghana. The highest for the period is 0.16 and -0.297 is the lowest. The official exchange rate in Ghana has averaged 1.391with the highest and lowest exchange rate also being 5.217 and .033 respectively. Inflation in Ghana has also averaged 23.912 with the highest and lowest inflation rate being 80.755 and 8.481. Domestic infrastructure averaged 29.969 with minimum and maximum values being 5 and 60 units respectively. In addition, Domestic credit to exporters in Ghana throughout the study has also averaged 11.388 as a percentage of GDP, also with minimum and maximum values being 3.657 percent and 16.7 percent

respectively. Trade freedom of EU members have averaged 80.011 percent with minimum and maximum values of 49.6 percent and 89.4 percent respectively. Concerning standard deviations, bilateral export to the European Union had the highest value (1720000000), followed by the population of the importers (25064954). The lowest standard deviation is the institutional quality of exporter (0.109).

Empirical Results and Discussion

The empirical results for the stochastic Frontier Gravity Model which employs the Maximum Likelihood Estimation Technique (MLE) are presented in this subsection. The results of the effects of the EU's environmental policy stringency and institutional quality on Ghana's bilateral export in line with the objectives of the study are presented in Table 2, 3, and 4.

Research Objective One: Effects of the EU's environmental Policy Stringency on Ghana's Bilateral Export

To determine the effect of the EU's environmental Policy Stringency on Ghana's bilateral export, a maximum likelihood estimation of the gravity model is estimated to determine whether the foreign policy has a significant relationship with Ghana's export. The gravity model is adjusted to accommodate the EU's environmental Policy Stringency and other relevant variables and the results are shown in Table 2.

Table 2: Effects of the EU's environmental Policy Stringency on Ghana's Bilateral Export

Dependent Variable: Log of Bilateral Export				
Independent Variable	Coefficient	Std. Err	Z	P-value
LogEnvironmental Policy Stringency	-1.6845***	.3923	-4.29	.000
Distance	-.00047***	.0001	-2.75	.006
LogGDP per capita of Ghana	3.1215	2.6959	1.16	.247
LogGDP per capita of importer	2.1244***	.2305	9.22	.000
Landlock	-2.6570***	.3291	-8.07	.000
LogPopulation of Ghana	1.2447	4.0913	.30	.761
LogPopulation of importer	1.5833***	.1163	13.61	.000
Exchange rate of Ghana	.0732	.2775	-.26	.792
Inflation of Ghana	.0034	.0065	.53	.597
Domestic credit to the private of Ghana	-.1933	.6585	-.29	.769
Infrastructure of Ghana	-.0025	.0084	-.30	.765
Common colony	-5.4058	.5559	-9.65	.000
Common official Language	1.3761***	.4212	3.27	.001
Trade Freedom of the importer	-.053	.0218	-.63	.528
Constant	-48.605	53.2203	-1.28	.201
sigma − square (v^2)	.622***	.1806	3.47	.001
sigma − square (u^2)	1.1934***	.3028	3.94	.000
Gamma $= \gamma = \frac{{\sigma_u}^2}{{\sigma_u}^2 + {\sigma_v}^2}$	0.7863			
Log Likelihood ratio	-870.0984			
Wald chi2	510.5800			
Number of observations	441			
Likelihood Ratio test of sigma	8.14***			

Note: ***, ** and * signify statistically significant at 1%, 5% and 10% respectively. i and j represent the exporter and importer country, respectively.

Source: Author's calculation, 2022

The findings displayed in Table 2 demonstrate that the estimated coefficients align with trade theory and a significant portion of them exhibit statistically significant results. The results demonstrate that there is a statistically significant negative relationship between the EU's environmental policy stringency and Ghana's bilateral exports. If the environmental policy stringency of partner countries from the EU increases by 1 percent, Ghana's export into the region reduces by 1.6845 percent. This is significant at a 1 percent alpha level. This demonstrates that an increasing environmental policy stringency of the import nation reduces the quantity of export from Ghana that goes into the region. In this instance, the EU's environmental policy stringency is acting as a barrier to Ghanaian exports.

Per this, the stricter the EU's environmental policies become, the more unfavorable the influence on Ghana's goods exports. A general reason for this negative effect of the EU's policy stringency on Ghana's export competitiveness could primarily be because of the capital investment required to meet the regulations. This tradeoff between foreign environmental regulation and export growth is in line with the findings of Jaffe et al (1995), Peterson (2003), and Hyuk-Ki Min (2010). The finding supports the pollution Haven hypothesis for Ghana. This tradeoff also brings to bare the fact that promoting and adhering to environmental policy standards are not often top priorities in regions where poverty alleviation, rapid economic development, and resolution of external and internal conflicts are urgent needs (Oliveira, 2002).

In most developing countries like Ghana, adhering to environmental standards must be proven solutions to the needs of citizens instead of one more problem to be solved. Although the future benefits of adhering to these global standards may be numerous in the future, citizens are usually concerned with immediate survival, and economic growth pressured by low incomes. Environmental issues and standards may come up during domestic economic activity, but they are hardly a priority, because they may not be immediately associated with domestic economic growth. But the effects of these micro-level activities usually will manifest at a higher level of aggregation as can be seen in the case of trade between Ghana and the EU. The results show that the consequences of this non-compliance with environmental regulations translate into a decline in the potential for national economic growth through, for instance, export inefficiencies.

Concerning bilateral distance, the results showed a negative significant effect on exports from Ghana. This variable is a proxy for transportation costs and other costs of the trade like communication costs, and transaction costs among others. This shows that long distances increase the cost of trade. This means that Ghana will trade more with nearby nations than with distant nations. In short, this shows that geographical proximity enhances trade between countries. At a 1 percent significance level, as the distance (in kilometers) between Ghana and her trade partners in the EU increases by 1 percent, Ghana's export decreases by 0.0005 percent. This implies that distance is a crucial factor that hinders trade flows

between Ghana and the European Union and in support of the findings of Hoekman and Nikita (2008), Deluna Jr and Cruz (2013), Hassas (2017) and Lee (2018).

The findings show a positive influence of the population of both Ghana and the European Union on Ghana's bilateral export. Population a proxy for market size revealed a positive relationship with Ghana's bilateral export. However, the population size of Ghana in the model is insignificant in the model even though it exhibited a positive relationship. The effect of the EU's population size on the other hand is statistically significant at a 1 percent alpha level. This demonstrates that there is a sizable market for Ghanaian goods and products in the European Union, and as a result, exports rise as the population of EU member countries rises. A percentage increase in the population of EU countries enhances Ghana's export. Specifically, a percentage increase in the population of trade partners will increase Ghana's export by 2.1244 percent. The aforementioned statement aligns with the principles of the Heckscher-Ohlin theory and supports the conclusions reached by Deluna Jr and Cruz in their study conducted in 2013, as well as the research conducted by Hassan in 2017.

The research also took into account distinct attributes of trading partners, such as their native language, geographical status as a landlocked or coastal country, and historical connections with exporting nations. The variable "Landlocked" exhibits a statistically significant negative effect at a 1% level. Thus, Ghana will often trade less with member nations of the European Union that are landlocked. Colonial ties exhibited a negative insignificant relationship with Ghana's bilateral export. The results also show the common language increases

trade flows between Ghana and members of the European Union and this is statistically significant at a 1 percent level. The conclusion drawn in the study conducted by Ravishankar and Stack (2014) aligns with the idea that bilateral trade flows are significantly improved by the use of a common language

Inflation and exchange rate shows a negative but statistically insignificant relationship with Ghana's bilateral export to the EU. Domestic credit to the private sector of Ghana and infrastructure in Ghana showed a negative relationship with Ghana's export to the EU but also statistically insignificant. The introduction of the trade freedom index for importers aimed to assess the impact of trading partners' market openness on Ghana's exports, but the results indicated no statistically significant effect.

Research Objective Two: Effects of Ghana's Institutional Quality on Ghana's Bilateral Export

For this objective, the gravity model is adjusted to accommodate institutional quality and other relevant variables in other to determine the effect of Ghana's institutional quality on Ghana's bilateral export. Table 3 shows a maximum likelihood estimation of the gravity model is estimated to determine whether Ghana's institutions have a significant relationship with Ghana's export.

Table 3: Effects of Institutional Quality on Ghana's Bilateral Export

Dependent Variable: Log of Bilateral Export				
Independent Variable	Coefficient	Std. Err	Z	P-value
Institutional quality	-5.1719*	2.6887	-1.92	.054
Distance	-.0006***	.0001	-3.69	.000

LogGDP per capita of Ghana	4.1598*	2.7304	1.52	.096
LogGDP per capita of importer	1.7074***	.2162	7.89	.000
Landlock	-2.7936***	.3258	-8.57	.000
LogPopulation of Ghana	-.2468	4.4047	-0.06	.955
LogPopulation of importer	1.4686***	.1149	12.77	.000
Exchange rate of Ghana	-.3129	.3434	-.91	.362
Inflation of Ghana	.0105	.0072	1.46	.144
Domestic credit to the private of Ghana	.5957	.6977	0.85	.393
Infrastructure of Ghana	-.0073	.0085	-0.87	.387
Common colony	-5.6053	.5668	-9.89	.000
Common official Language	2.0909***	.5668	5.34	.000
Trade Freedom of importer	-.0389	.0213	-1.82	.068
Constant	-44.3769	49.6811	0.74	.462
sigma − square (v^2)	.6933***	.1737	3.97	.000
sigma − square (u^2)	1.16543***	.3150	3.80	.000
Gamma $= \gamma = \frac{{\sigma_u}^2}{{\sigma_u}^2 + {\sigma_v}^2}$	0.7449			
Log Likelihood ratio	-877.78004			
Wald chi2	473.69			
Number of observations	441			
Likelihood Ratio test of sigma	7.03***			

Note: ***, ** and * signify statistically significant at 1%, 5% and 10% respectively. i and j represent the exporter and importer country, respectively.

Source: Author's calculation (2022)

The significance of institutions in the economic prosperity of nations is increasingly being acknowledged in a growing body of research. Table 3 presents the effects of Ghana's institutional quality on her bilateral export performance. It is

evident from the descriptive statistics that the average institutional quality for the study period is -.106, which indicates a usually weak institutional quality. The results show a negative and statistically significant relationship between institutions and export performance. This confirms the perception that institutions are weak in Ghana

At a 10 percent significant level, the quality of institutions is estimated to have a negative relationship with export. This generally shows that when the quality of institutions in Ghana reduces, export to the European Union is increases. In economies with low institutional quality, corruption is more prevalent, making it easier for businesses to engage in rent-seeking behavior and gain unfair advantages in international trade. In the case of Ghana this relationship with bilateral export is, however, not surprising considering the fact that corruption and bribery in customs Administration processes in Ghana are very widespread (GCR, 2016), with government institutions like the Environmental Protection Agency, Ghana Standards Authority and other institutions also becoming increasingly non-functional because of high levels of bribery and corruption in the public sector. This weak environmental and institutional regulation in Ghana (Liedong and Frynas,2018), tends to attract industries that produce pollution or emissions out of which goods are exported. These weak institutions make it easier and cheaper for firms to pollute, and exploit labor which lead to cost savings and increased competitiveness in international markets (Brown, Deardorff, & Stern, 2004; Wu, 2005: Hegemann & Berumen, 2011) increasing exports from the host country. This result goes to confirm the findings of Solarin, Al-Mulali, Musah, and Ozturk

(2017), Mensah, Dauda, Boamah, and Salman, (2021), and Gyimah, and Yao (2022) who asserts that Ghana is a pollution haven economy.

These situations are what sometimes result in rejections and export prohibitions over a period for specific products. For instance, in 2013 Ghana was blacklisted by the EU for the export of tuna because enforcement of the illegal, unreported and unregulated (IUU) regulatory framework was lacking (Maale-Adsei, et al, 2015). This was in suspicion that consignments from Ghana were contaminated with illegally caught fish. In October 2014, the EU prohibited the shipment of gourds and Asian vegetables from Ghana to European markets due to concerns that the produce would be plagued with pests that would then be introduced into the EU's ecosystem. Currently, Ghana risk ban on cocoa products because of risks chemical residue and leaches into cocoa and other plants as a result of illegal and environmentally unfriendly mining. All these embargoes are a result of the production of these goods in an environmentally unsustainable manner.

Furthermore, as commonly indicated by the gravity model, the variable representing bilateral distance variable confirms a negative significant relationship in this model. This shows that geographical location is important in improving export flows between Ghana and the European Union. The results denote that the farther away the trade partners are the smaller Ghana's export of goods becomes. The geographical position of trade partners (whether landlocked or not) is also seen to be negative and statistically significant by a level of 1 percent in the model. Thus, Ghana will often trade less with member nations of the European Union that are landlocked. GDP per capita has a positive relationship with bilateral export at a

significant level of 10 percent. Specifically, a percentage increase in Ghana's GDP per capita increases her export by 4.1598. Also, as GDP per capita of trade partners increase by 1 percent, Ghana's export increases by 1.707 percent. The population of trade partners also exhibits a positive relationship with Ghana's export by a significant level of 1 percent.

Common colonial ties and trade freedom of importers exhibited negative relationships with bilateral export at insignificant levels. Common official language also exhibits a positive relationship with bilateral exports. The estimate's positive indication implies that exports from Ghana to English-speaking nations enhance their export efficiencies in comparison to countries that do not speak English. Furthermore, this finding holds statistical significance at a 1 percent alpha level.

Infrastructure and exchange rate shows a negative but statistically insignificant relationship with Ghana's bilateral export to the EU. Domestic credit to the private sector of Ghana and inflation in Ghana showed a positive relationship with Ghana's export to the EU but also statistically insignificant.

Research Objective Three: Effects of Ghana's Institutional Quality and EU's Environmental Policy Stringency on Ghana's Bilateral Export

For the third objective, the gravity model is also adjusted to accommodate both the EU's environmental policy stringency, institutional quality, and other relevant variables. To achieve this objective, a maximum likelihood estimation of the gravity model is estimated to determine whether the foreign environmental policy stringency and Ghana's institutions have a significant relationship with Ghana's export. The results are shown in Table 4 below.

Table 4: Effects of the EU's Environmental Policy Stringency and Ghana's Institutional Quality on Ghana's Bilateral Export

Dependent Variable: Log of Bilateral Export				
Independent Variable	Coefficient	Std. Err	Z	P-value
LogEnvironmental Policy Stringency	-2.0362***	.5009	-4.07	.000
Institutional Quality	-2.2312	3.4675	-0.64	.520
EPS#INST	-2.2893	1.9364	1.18	.237
Distance	-0.0004**	.0001	-2.51	.012
LogGDP per capita of Ghana	4.2687	2.715	1.53	.127
LogGDP per capita of importer	2.0871***	.2306	9.07	.000
Landlock	-2.6554***	.3264	-8.13	.000
LogPopulation of Ghana	4.1056	4.770	.91	.363
LogPopulation of importer	1.5889***	.116	13.72	.000
Exchange rate of Ghana	.46288	.346	1.37	.171
Inflation of Ghana	.00064	.008	0.87	.383
Domestic credit to the private in Ghana	-.1225	.0071	-0.16	.869
Infrastructure of Ghana	-.0031	.008	-0.37	.711
Common colony	-5.4072	.558	-9.69	.000
Common official Language	1.3650***	.4201	3.27	.001
Trade Freedom of importer	-.007	0.022	-.32	.749
Constant	-124.4178	67.428	-1.99	.313
sigma − square (v^2)	.6407***	.1818	3.54	.000
sigma − square (u^2)	1.13714***	.3223	3.53	.000
Gamma $= \gamma = \frac{\sigma_u{}^2}{\sigma_u{}^2 + \sigma_v{}^2}$	0.7739			
Log Likelihood ratio	-868.27038			
Wald chi2	516.46			
Number of observations	441			
Likelihood Ratio test of sigma	7.27***			

Note: ***, ** and * signify statistically significant at 1%, 5% and 10% respectively. i and j represent the exporter and importer country, respectively.

Source: Author's calculation (2022)

The third objective provides a useful insight into Ghana's institutional quality and the way it affects the effects of the EU's environmental policy stringency on Ghana's bilateral exports to the EU.

The results from Table 4shows that the interacted term between quality of institutions, and EU's environmental policy stringency reduces export by a statistically insignificant term. The coefficient of bilateral distance was again confirmed to be negative in the gravity model. Thus, Ghana is expected to trade less with countries that are farther away from her. Specifically, it showed that a kilometer increase in the bilateral distance between Ghana and her trade partners reduces the volume of trade between them. This was significant at a level of significance of 1 percent. GDP per capita which was used as a proxy for the size of the economy showed a positive relationship with Ghana's bilateral export. This shows that the size of both Ghana's economy and trade partners economy is important in promoting Ghana's export. Even though insignificant, a percentage increase in Ghana's GDP per capita increases Ghana's bilateral export by 4.2687 percent. At 1 percent level of significance, a percentage increase in trade partner's GDP per capita was found to increase Ghana's bilateral export by 2.0871 percent. In line with theoretical expectations, trade partner's geographical position (whether landlocked or not) confirmed a negative relationship at 1 percent level of significance. This shows that Ghana will trade less with landlocked countries.

The population size of Ghana and trade partner also exhibited a positive relationship with Ghana's bilateral export. However, only the population of the trade partner has a significant relationship. At 1 percent level of significance, a

percentage increase in the population size of trade partner increases Ghana's bilateral export to that country by 1.588 percent. Common colonial ties and trade freedom of importers showed negative but insignificant relationship with Ghana's bilateral export. Common official language also exhibits a positive relationship with bilateral exports. The estimate's negative sign indicates that, in comparison to non-English-speaking nations, Ghana's exports to English-speaking nations increases her export efficiencies. This is also statistically significant at a 1 percent alpha level.

Infrastructure, domestic credit to the private sector of Ghana, exchange rate, and trade freedom of importer shows a negative but statistically insignificant relationship with Ghana's bilateral export to the EU. On the other hand, inflation in Ghana showed a positive relationship with Ghana's export to the EU but also statistically insignificant.

For the purposes of robustness, the study went ahead to look at the effect of the EU's environmental policy and Ghana's institutional quality on some specific commodities to determine which commodities are affected the most.

Table 5: Effects of the EU's Environmental Policy Stringency and Ghana's Institutional Quality on Ghana's Bilateral Export (Specific Goods)

Independent Variable	Model 1 (Manufactured goods)	Model 2 (Agricultural Goods)
LogEnvironmental Policy Stringency	-1.7105***	-2.4078***
	(.3834)	(.57106)
Institutional Quality	.6790	-4.7740
	(2.5937)	(0.211)
EPS#INST	-2.4453	-3.5799
	(1.4572)	(2.1860)
Distance	-.0001*	-.0006**
	(.0001)	(.0002)
LogGDP per capita of Ghana	.7183	2.30138
	(2.0941)	(3.0667)
LogGDP per capita of importer	1.4545***	2.5222***
	(.1689)	(.2544)
Landlock	-.6840***	-.7100**
	(.2200)	(.3214)
LogPopulation of Ghana	-.8410	5.4581
	(3.3942)	(4.9196)
LogPopulation of importer	1.7869***	.1438***
	(.0851)	(.1438)
Exchange rate of Ghana	.0879	.5802
	(.233)	(.38041)
Inflation of Ghana	.0003	-.5802
	(.0055)	(.3804)
Domestic credit to the private in Ghana	-.4418	-2.398
	(.5643)	(.82072)
Infrastructure of Ghana	-.0018	.0
	(.0062)	(.0092)
Common colony	-.6655	-1.8428
	(.4192)	(.6285)
Common official Language	1.0240***	1.5001***
	(.3112)	(.4812)
Trade Freedom of importer	.0931***	.0246
	(.0167)	(.0247)
Constant	-31.2729	-145.4985
	(47.09023)	(68.4655)
sigma − square (v^2)	.5306***	.4927**

	(.0704)	
sigma − square (u^2)	-1.290*	1.9069***
	(1.14)	
Gamma $= \gamma = \frac{{\sigma_u}^2}{{\sigma_u}^2 + {\sigma_v}^2}$	.885	0.9374
Log Likelihood ratio	-742.8253	-926.93727
Wald chi2	957.15	395.36
Number of observations	441	441
Likelihood Ratio test of sigma	0.32*	13.18***

Note: ***, ** and * signify statistically significant at 1%, 5% and 10% respectively. i and j represent the exporter and importer country, respectively.

Source: Author's calculation (2022)

The effects of the EU policy stringency and institutional quality were also examined on disaggregated trade products. Manufactured products and agricultural products were selected from the SIC classification of goods for this purpose. The results suggest the EU's environmental policy stringency harms the export of the two commodities. The effect on both commodities is significant at a statistically significant level of 1 percent. The effect of the EU policy stringency is slightly greater on agricultural products (2.4078) than on manufactured products (1.7105). In comparison to a decrease in exports of agricultural goods of 2.4078, a tightening of EU policy reduces exports of manufactured goods by 1.7105. The huge effect of the environmental policy stringency on Ghana's bilateral export of these two broad items from Ghana could be attributed in large part to the integration of sector-specific environmental considerations into EU trade agreements. Sector-specific policy initiatives have a significant impact on influencing the environmental sustainability of trade through the implementation of criteria and standards that govern the entry of products into the European Union marketplace.

According to the Institute for European Environmental Policy (2020), the recommended approach involves directing the criteria and standards towards European Union (EU) operators. They are responsible for conducting thorough investigations into the origins of imported goods and ensuring compliance with relevant state authorities. The European Union's product standards for imported manufactured goods are very comprehensive ranging from chemical content standards, packaging standards, eco-design standards, energy efficient standards, etc. The purpose of this strategy is to assist the Union in achieving its larger environmental objectives within Europe and beyond. In this sense, the EU products policy is an enabler to help deliver on ambitious environmental goals and aims to reduce raw material use and improve recycling rates and outcomes (Europen Steel Association, 2020). Another typical case of such policy is the EU's IUU (illegal, unreported and unregulated) fishing policy and CFP (Common Fisheries Policy). The CFP largely regulates EU fishing fleets' activities in non-EU waters, and the EU IUU regulation covers all fish products of its own member states and external partners (Auethavornpipat, 2021).

Institutional quality showed a positive coefficient for manufactured exports and negative coefficient for agricultural exports but both showed statistically insignificant relationship. The bilateral distance used as a proxy for transportation cost exhibited a negative relationship with the export of both commodities indicating that the farther the distance between Ghana and its EU export partners the more expensive it is to trade with them. Similarly, landlock also exhibited a negative relationship between Ghana and its export partners. In line with theoretical

underpinnings and expectations, GDP per capita and the population of trade partners exhibited a positive relationship with the export of both commodities. Other variables such as common colony and language showed the expected relationships.

Post-estimation Tests

The Gamma (γ) Coefficient.

The Gamma coefficient is defined by equation 17. The results generated by the frontier computation provide estimations for two error components namely σv and σu, referred to as sigma v and sigma u, respectively. These components are quantified as $\ln\sigma_v{}^2$ and $\ln\sigma_u{}^2$, in log-likelihood. In the output/model they are denoted as $\text{sigma} - \text{square}\ (v^2)$ and $\text{sigma} - \text{square}\ (u^2)$. The term $\sigma_u{}^2$ represents the variability in the one-sided error or the inefficiency error term while $\sigma^2{}_v$ represents the variance of the double-sided random error factors extending beyond boundaries. The gamma parameter value spans from zero to one. When the gamma coefficient approaches 1, it indicates a significant contribution of technical inefficiencies, thereby validating the utilization of the SFGM. This coefficient elucidates the extent of variation in the composite error term resulting from trade constraints beyond the borders, which are regulated by the one-sided error term. A negative gamma signifies that the inefficiencies originate from the importing nations, whereas a positive value suggests their origin in the exporting country.

The findings indicate that the sigma-squared (σ^2), value, representing the average overall variation in the model over time, is statistically significant at a 1 percent significance level. This suggests that the potential exports of Ghana experienced changes during the period examined. The variation in potential exports

between Ghana and its trading partners may be attributed to random factors or specific characteristics unique to Ghana and the respective trading partner countries. Additionally, the gamma (γ) coefficient provides further insight into the nature of this variation by quantifying the proportion of variation due to country-specific socio-political-institutional factors or, simply put, the constraints within the country affecting overall variation. The gamma coefficients in models 1, 2, and 3 are 0.7863, 0.7739, and 0.7449, respectively. These coefficients demonstrate high significance at the 1 percent level. With values of 0.7863, 0.7739, and 0.7449, it can be inferred that export inefficiency accounts for over 70 percent of the variation in Ghana's bilateral export flows. Consequently, this implies that behind-the-border constraints have a substantial influence and contribute significantly to the average overall variation in this case. Thus, the Stochastic Frontier analysis conducted in this study yields meaningful and valid results. Furthermore, this suggests that factors such as the EU's environmental policy stringency, which limit Ghana's exports to the European Union, are within Ghana's sphere of control.

Likelihood ratio Test

The frontier model reports tests under the null and alternative hypotheses, H_O; there are no technical inefficiencies, and H_1: there are technical inefficiencies. If the null hypothesis involves $\gamma = 0$, indicating that the technical inefficiency effects are not present in the model. If the null hypothesis is true, the stochastic frontier model reduces to an OLS model with normal errors. For the first model the output shows LR = 8.14 with a p-value of 0.002, the second model shows an LR test of 7.24 with a p-value of 0.004 and the third model also shows an LR test of

7.58 with a p-value of 0.003. For all three models, a null hypothesis of no inefficiency is rejected.

Chapter Summary

The Stochastic Frontier Gravity Model was used to analyze the effect of the EU's environmental policy stringency and Ghana's institutional quality on Ghana's bilateral exports to the EU. The results reveal that EU policy stringency negatively affects Ghana's bilateral exports. The results also reveal that the inefficiencies in Ghana's institutions contribute to the poor performance of Ghana's bilateral exports to the selected EU countries.

CHAPTER SIX

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

Introduction

In this section, a comprehensive overview of the study's findings is presented, along with corresponding conclusions and policy recommendations. Additionally, suggestions for future research directions and policy considerations are provided.

Summary

Ghana has been pursuing an export-oriented growth strategy since the 1980s in its endeavor to achieve middle-income status. Throughout the course of this export-oriented strategy, the European Union has been a significant market for her exports. Despite getting a declining share of the EU's market since the beginning of the growing environmental awareness in the European Union, the European Union market remains an important market for Ghanaian Exports. Moreover, Europe exhibits a strong inclination towards niche goods, creating a significant opportunity for Ghanaian manufacturers to meet the demand while aligning with environmental sustainability goals. The long-term outlook indicates a sustained or increased desire for such products within the European market. Hence, it becomes evident that Ghanaian exporters, who manage to penetrate this market while addressing the rising awareness of environmental sustainability, stand to benefit financially from its lucrative potential.

Also, institutions have been credited with the performance of exports in the face of environmental awareness in the literature. The dominant view of agencies

in charge of regulating trade and ensuring environmental policy compliance in developing countries like Ghana which the study focused on is that they lack the institutional, political and financial muscle to fulfill the most basic responsibilities. The study aimed to examine the effect of the European Union's environmental policy stringency and Ghana's institutional quality on Ghana's export to the EU using panel data from 1990-2019. The study's theoretical background is the Porter, Pollution Haven hypothesis, New institutional economic theory and the environmental Kuznet curve.

The study used the stochastic gravity model to estimate the results of the study. The study used the maximum likelihood estimation to estimate the parameters of the gravity model which was adjusted to accommodate the policy stringency and institutional quality. The frontier estimates revealed that the EU's policy stringency negatively affects Ghana's bilateral export. The quality of institutions revealed a negative relationship with Ghana's bilateral export. The results also discovered that with the current level or average quality of institutions, the adoption of EU's policy stringency also exhibits a negative relationship with Ghana's bilateral export. The other variables of the gravity model also showed the expected signs in line with economic theory. The estimates revealed that Ghana's bilateral export flows are positively influenced by GDP, common official language, and the population of importing country. Distance between trading partners negatively affects exports as well as geographical position (whether landlocked or not).

Conclusions

Drawing on the empirical evidence from the first objective, which sought to investigate the effect of the European Union's environmental policy stringency on Ghana's bilateral export based on the frontier estimates, brought to light that the policy stringency has a negative effect on Ghana's bilateral export to the selected European Union member countries. Also, the results found that the GDP of member countries, population size which proxy the size of the trading partner's economy, and common official language significantly increased Ghana's export. Distance, a proxy for transportation cost, and landlocked trading partners hurt the flow of Ghana's export.

Again, the study's second goal was to explore how Ghana's institutional quality affected its exports to the European Union. The results revealed negative significant effects on exports. This is due to Ghana's generally weak institutions, and protracted bureaucracy, all of which seriously hamper trade. Here also the results found that the GDP of member countries, population size which proxy the size of the trading partner's economy, and common official language significantly increased Ghana's export. Distance, a proxy for transportation cost, and landlocked trading partners hurt the flow of Ghana's export.

The third objective of this research was to estimate the effect of the European Union's policy stringency and institutional quality on Ghana's bilateral export. The results again showed that the interacted term of the European Union's policy stringency and Ghana's institutional negatively impacts Ghana's bilateral export but insignificant. The research confirmed the validity of the pollution haven

hypothesis which meant that these firms would have to incur additional costs in order to satisfy these strict environmental regulations which reduces the country's export competitiveness.

Recommendations

Based on the findings of the study, the following recommendations are proposed to policymakers. International trade plays a significant role in the economic development and progress of most nations, particularly developing nations like Ghana. To achieve this, initiatives to close or minimize export inefficiencies must be implemented.

The first recommendation to Ghanaian policymakers is to utilize "green countervailing duties" to equalize environmental costs between producers in Ghana and the European Union so that Ghanaian producers wouldn't have to consider achieving different requirements for the domestic market and the EU market. Another is to discuss a downward harmonization of standards with the European Union in a mutually beneficial arrangement. This is primarily meant to lessen disparities in standards, not necessarily that environmental standards should be lowered to harmful norms.

Another recommendation will be to address the inefficiencies to improve the institutions responsible for overseeing or regulating economic activities in Ghana. Institutions like the Food and Drug Authority, Customs Office, and Ports and Harbors Authority and the Environmental Protection Agency should be strengthened by equipping them with the necessary logistics, human capital and finances needed to execute their duties efficiently. This statement suggests that

carrying out institutional reforms to improve institutional quality is a critical factor in government policy that will help obtain greater bilateral export benefits. Also, Political support for strict standards can be strongly entrenched in political systems such that any attempt to reduce them would be exceedingly risky from a political standpoint.

At the same time, it's important to ensure that policies to address the inefficiencies in institutions are inclusive and sustainable, and take into account the needs and interests of all stakeholders This could involve measures such as enhancing social safety nets, investing in green infrastructure and renewable energy, and promoting responsible business practices.

Suggestions for Further Research

Future studies can consider a similar analysis by investigating the effect of environmental policy stringency on Ghana's export by focusing on other trading blocs such as ECOWAS or APEC region. This approach will, nonetheless, contribute to formulating a distinct policy framework that can influence the specific group. Additionally, numerous socio-political and institutional factors contribute to export inefficiencies, although the study did not cover all of them comprehensively. Future studies can look at how the individual six institutional quality indicators as measured by World Governance Indicators will look in the inefficiency model and their effect on Ghana's exports.

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APPENDICES

APPENDIX A: List of Sampled Ghana's Major Trading Partners from the European Union

EUROPEAN UNION (EU)
Austria
Belgium
Denmark
Finland
France
Germany
Greece
Hungary
Ireland
Italy

Poland
Portugal
Spain
Sweden
Norway
Netherlands
United Kingdom

APPENDIX B: Generalized Likelihood ratio test of Hypothesis

Null Hypothesis	1990-2015 *Test Statistic*	Critical Mixed *P Value of test*	Decision	Conclusion
$H_0: \mu = 0$	8.23	0.002	Reject the null hypothesis of no inefficiency	The use of the Stochastic Frontier Gravity Model (SFGM) is sufficiently justified.
$H_0: \mu = 0$	8.04	0.002	Reject the null hypothesis of no inefficiency	The use of the Stochastic Frontier Gravity Model (SFGM) is sufficiently justified.
$H_0: \mu = 0$	7.99	0.002	Reject the null hypothesis of no inefficiency	The use of the Stochastic Frontier Gravity Model (SFGM) is

				sufficiently justified.

Note: Critical value is at the 5 % level of significance and the test statistic is obtained from the estimation results.